Paving and Municipal Engineering

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ARTISTIC EFFECT IN STREET IMPROVEMENT.

WHILE much is being very properly said and published to-day on the improvement of our thoroughfares, the entire object of such agitation seems to be for the benefit of traffic alone. The facilitating of traffic, of course, is the main object to be attained, but if we can by a little thought incorporate in our plans a scheme for the beautifying as well of our thoroughfares, we will have accomplished a most commendable object. We pride ourselves as Americans on being progressive, but when one observes how many things we simply imitate in principle, under a cloak of disguise as new, he will find out we do not progress in the manner we should. Because we have introduced a number of improved materials for paving, we point with pride to the great change in construction of our thoroughfares, while in other vital particulars we continue in the same old ruts. Before we proceed to consider any of the methods to be employed to benefit the appearance of our streets, let us consider some of the objectionable features to be avoided, if possible.

Probably nothing detracts more from the good appearance of a street than any abrupt change of form or grade, such as cause inconvenience to the traveling public. The most common of such is the difference of elevation of sidewalks and roadways and crossings. One of the growing evils in our streets is the admission of the numerous lines of unsightly poles of the electric companies. Why these corporations should be extended such privileges is not plain. For instance, all electric light, telegraph and telephone lines could as well follow alley lines as streets. The electric street car lines string their trolley system on the score of economy, making equally as bad an appearance.

But corporations are not alone in marring the effect of our

streets. Each individual along a line of street seems in many cities and towns, by common custom, to have a license to erect any kind of an awning, stair, step, sign or other advertising device novelty may suggest to his fancy. While these matters do not enter into the physical condition of streets they surely destroy many benefits otherwise enjoyed, and our improvements should be made with a view of having all such things as detract from the appearance of our streets excluded.

Again, let us consider some of the comparative effects of a well-appearing and a marred street. The pride of all towns and cities is to increase in size, and this will be the more rapidly accomplished by attracting outsiders to join their lot with the place. Next to obtaining employment, what attracts one's attention more to a town than its general appearance? The first thing a new comer beholds is the public thoroughfares over which he passes, for over these he must pass in order to make any investigation regarding the place. Well-proportioned and improved streets bespeak the spirit of the people who caused them to be made.

Again, it may be observed, that according as public improvements are made a similar spirit invariably takes hold of the citizen adjacent to such improvement, and at the earliest opportunity his property will be found to have assumed a condition in keeping with the public improvement. Notice when a thoroughfare is nicely graded and paved, even in the most neglected district, how soon you will see new fences, and new yard-walks leading to the houses, and also new steps. Trees will be trimmed up and the whole yard or building front put on a new air. Buildings will be arranged to conform in grade, line and other particulars. If a well executed public improvement will work so much change on present population, how much more will be its effect on the generations to follow, and with what studied care should they be made to meet the requirements of the future?

To return more strictly to the title of our article, as to the art to be employed in our street improvement, it will be hard to lay down any fixed rules to be followed, for the requirements of different towns and even the several localities of the same town are so

varied that nothing but a specially arranged course by a competent engineer on the ground will be satisfactory.

There are many points of a general or common nature in our present practice that will bear very serious consideration, and quite likely in so doing will result in some radical changes for the better. As a general rule our sidewalks are too high above the street, necessitating an unsightly and dangerous contrivance at block corners and street crossings to enable pedestrians to pass over. The prime cause leading to this is that ample provisions for street drainage or the relieving at frequent intervals the gutters of the streets are rarely made. Our gutters seem to be constructed more as receptacles for the accumulation of filth than as a means of rapidly leading such to a proper place of disposal. Engineers will be commended if they can devise a means of disposing of street and gutter refuse somewhere else than at or near street crossings, especially at corner crossings. Possibly no radical change in location or form of gutter or curb will suggest themselves, but surely at street crossings a little study will result in a display of some things of pleasing effect. Let the gutters be trapped a few feet before reaching a crossing, and thus enable the descent from walk to street to be made by an easy and graceful curve with no abrupt or sudden change. In fact, let the crossing be a continuous, unbroken path. Immediately at the street crossings there will be accumulations from the crossing itself, and a provision can here be made to also hurry this out of sight.

The turn at street junctions should be made by easy curves of as large radius as circumstances will permit. A curve struck from the lot or building corner as a center of the same radius as the width of the walk will not hamper pedestrians and will be beneficial to vehicle passage. In place of the large corner curb blocks forming an abrupt bend let an ornamented portion of masonry wall, forming a seat, a drinking fountain or other public comfort, be thrown in to mark the line between vehicles and pedestrians. Here is a very appropriate place for the display of such art as can be afforded. These are matters that can be introduced upon our business streets and more crowded thoroughfares. When we come to reach out into our residence districts our opportunity for the introduction of the true and beautiful in nature and in art broadens to

such an extent as our wealth will permit. But wealth is not necessary to obtain all of these. Very often a street could be improved at less expense by the introduction or possibly the retaining of more of nature as there implanted.

Why do we demand a standard form or extent of paving on all streets regardless of the requirements of present or prospective traffic? Let us pave only to such extent as will be required during the life of our paving material, reserving a goodly portion of what nature has bestowed upon us, to be enjoyed until such a time as traffic forces its demands upon it. Are not the reserving, grading and seeding of lawn space and planting of trees or shrubs along our thoroughfares as much matters of public benefit as are other portions of the improvement? We, as true Americans, must begin to realize that our labor must accomplish its proportionate share of good for the development and sustenance of the inner and better nature of man, if we wish to attain and maintain good citizenship.

All can not have access to parks and lawns or enjoy the art of man, but surely we should protect and nurture the art God has left us in nature. It has been truly said, "A thing of beauty is a joy forever," and what brings joy aids in bringing health, and health is everything. It makes active men who will be a power in the advancement of our towns, so that it can be traced out that art on even our thoroughfares has a monetary value.

The things to be employed to directly and especially lead to the development of art in street improvement will be left to the consideration of those in charge of each special case and such aid as they desire to employ.

A very important point not touched upon must be mentioned, and we hope those having closer relations with such matters than the writer will give it some attention, and possibly be heard from with valuable suggestions. We refer to bridge, viaduct and waterway structures.

Outside of a little cheap scroll work on the portals of our bridges, where is such a thing as art manifest? The average structural iron work is about as attractive as the complex sheet of figures under which it was designed. Masonry structures are susceptible of having greater grace and ornamentation given them, and are consequently growing in favor to some extent on this account. The

stone age is reviving and let our art keep pace with it. Let our engineers embody more art with their work where it can be done without sacrificing essentials of good construction.

Frank Knight.

THE ORIGIN OF AMERICAN ASPHALTIC PAVEMENTS.

[The following account of the origin of the American asphaltic pavements was written by Prof. DeSmedt, the inventor, at the special request of the editor of MUNICIPAL ENGINEERING.]

I WAS early interested in the asphalt pavements of Paris, and experimented and analyzed the materials used in their construction. Having come to the United States in the year 1861, I did not lose sight of the asphalt paving question. In the year 1869–70 my attention was called to the subject of concrete pavements, and my efforts were directed toward finding a composition that should be equal to the natural rocks of the Val-de-Travers and Seysel for paving purposes, and that should rival those materials, at least in cheapness. In the course of my experiments I conceived of the combination of silicious sand or pulverized carbonate of lime, mixed or each separate, cemented together by Trinidad asphalt, or any other suitable asphalt, the latter being first tempered with heavy petroleum oils or the residuum of the distillation of those oils. In February, 1870, I applied for United States letters patent, which were granted, and are now in public use.

Samples of the improvements were laid, in the course of my experiments, in and around our works in Jersey City, and in the summer of 1870 about five hundred square yards were laid in front of the city hall in Newark, during the existence of the American Asphalt Pavement Company of New York, Adolphus Shafer, president.

The American Asphalt Pavement Company, the Grahamite Asphalt Pavement Company and the Grahamite and Trinidad Asphalt Pavement Company were successively formed. The name of Grahamite was given to these companies out of respect to General Lorimore Graham, and I was the chemist and superintendent of

these companies, and asphalt pavements were laid in accordance with my invention.

Under these various companies but little more than good sized samples were laid for several years. The most notable successes were the pavements laid in 1873 on Fifth avenue, between Twenty-fourth and Twenty-fifth streets, near Worth Monument, and in Bramble Place, from Duane to Thomas streets, in the city of New York, and on the east side of Sixth street, in front of Independence Hall, opposite the Ledger Building, in the city of Philadelphia. These specimens fully demonstrated the durability of the pavements laid under my own direction, and with the following composition: Fine sand, pulverized carbonate of lime, Trinidad refined asphalt, tempered with residuum of the distillation of petroleum oil. This latter mixture of petroleum oil and asphalt is termed "asphaltic cement." The asphaltic cement is separately heated to about 300° F. The sand and carbonate of lime, being mixed in given proportions, are also heated by rotary drums to about 300° F., and mixed with the asphaltic cement in a suitable mechanical mixer. It is then carted to the street where it is spread to the necessary thickness, tamped and rolled by heavy rollers in order to obtain the desired compactness.

In 1876 congress appointed a special commission, consisting of General H. G. Wright, chief of the engineer corps of the United States army; General Q. A. Gillmore, also of the engineer corps, and Hon. Edward Clark, architect of the capitol, with full power to repave Pennsylvania avenue, Washington, D. C., and with no restriction as to cost or construction of any kind, except to select and lay the best known pavement.

This commission advertised for public proposals—every bidder to furnish his own specifications. Several offers were received. The commission selected the "Grahamite and Trinidad," over all others, to be laid like the Fifth avenue pavement above referred to, and under the superintendence of Prof. E. J. DeSmedt. This was the first victory for my invention.

After the formation of the new municipal government of Washington, with Major Wm. J. Swining as engineer commissioner, I was appointed inspector of asphalt pavements and hydraulic cem-

ents and chemist for the District of Columbia. My duty was to inspect and superintend the working and laying of asphalt pavements, according to my invention, to all contractors. This invention has now spread all over the United States, and is yet executed exactly as I invented it, and no improvement has been applied on my specification.

E. J. DESMEDT.
Biograghical Sketch in November Number, 1893, p. 208.

This system can, nevertheless, be improved, and I am sure to have discovered a system which brings this pavement to a greater perfection, of which in a short time I will give in your magazine a full description. *E. J. DeSmedt, Chemist.*

HOW FRANCE GOT GOOD ROADS.

THE general movement all over the United States toward improving country roads offers a peculiar contrast with all other ideas that are from time to time brought to the front for public investigation.

First, in all the innumerable articles that have been written on the subject there has been no need of exaggerations. The pecuniary loss to farmers and to the nation at large, the loss to education and progress in rural districts all is true, undeniably true. It is my candid opinion, based on experience, that we are just as far from realizing the changes that will be worked in this country when our system of roads will be brought to perfection as the first railroad builders were from realizing the wonders steam would work.

Next, though the movement is general, all papers are pushing it—there is no antagonism. No one dares to step to the front and say, "We do not need better roads."

Therefore, if my judgment is good, we are going to see a new era, as far as roads are concerned, and many states, if not all, will have to pass some laws to that effect. Great efforts will be made to make them as perfect as possible, and if my experience can add anything to the general stock of information already gathered, I am willing to do my share.

It has been repeatedly stated that France has the best system of roads. I then will speak of them.

In France the roads are divided into three classes: the national roads, built and maintained by the government; the department roads, built and maintained by the department, which would about correspond with our states, and the vicinal roads, built and maintained by the countries. Besides these, villages have a number of small roads or streets leading to their most important points; but those of merely local interest do not belong to the general system.

Most of the national roads were built by the government for general use previous to the railways, when freight was hauled from city to city by horse power, and when public hacks were all the luxury a traveler could enjoy.

It would be an error to believe that the many good roads France has are the result of a slow progressive process, dating from the time of the Romans; the truth is, that the department and vicinal roads are of recent construction. About fifty years ago France was in as bad a condition as we are at present, and to-day their country roads are working wonders. It is said that the country furnished a large amount of the money to pay the Prussian debt, and we learn that it was the farmers who invested their money in the Panama canal scheme. Though the farmer derives the largest profits from good roads, it was not he who asked for them. He had very little to do about the matter but to pay his tax.

The government, especially since the reign of Napoleon I, was always in favor of good roads, and many had been built already when Napoleon III came into power. They had then been thoroughly tested. It had become evident to all, at least those versed in political economy, that the greatest and surest source of wealth a nation has is agriculture, and that in order to get a full value of the crops, each village, however distant or remote from big cities, had to be reached by at least one good road; so a law was enacted compelling the department counties and communes (townships) to construct so many miles of road each year. It is unnecessary to state here precisely how the law was worded or how the farmer objected. I will simply state that he yielded, and that the good work was

done for the direct benefit of the farmer against his own will, and at present he is recognized as the richest farmer in Europe.

How can we do something similar here?

The most serious objection I have heard against such an arrangement is that the citizens of the United States are too proud to surrender their rights. Each town or township having charge of its roads will not let the state infringe upon their privileges. That is very well—a free citizen ought to be proud. Frenchmen also are proud, but if free citizens are proud they are also intelligent.

The United States has taken charge of the post-office and revenue departments. Everybody is satisfied. The states have granted charters to railroads; have given them the privilege to go through hills and vales, regardless of the rights of towns. The states have also granted charters to villages and cities, giving them the power to order improvements made and assess the tax-payers for the same, without troubling them with a vote on the question.

The towns have had a fair show for many years, and they have accomplished nothing whatever. Our roads are just as bad, and probably worse than thirty or fifty years ago.

I do not pretend to dictate to our legislatures what they ought to do, but it is evident from our experience of the past that a power must be created to order and build roads—in other words, there must be a centralization, or there will be no unity of action.

With unity of action we will have uniformity of work. Some localities have good road-making materials; some have not. Some towns will be so situated so as to have but a small mileage of roads to build, where others will have more than their share. The centralization will balance the expenses more evenly, and whatever assessments are made, special taxation to property-owners should be but a small fraction, county and states paying the rest.

The board of supervisors of Adams county, Illinois, have adopted a draft of road laws, which would hit my ideas very well were it not that they leave the whole thing to a vote of the township through which a road would pass. That would certainly kill the best planned road in the country. You will never get a farmer to vote for a tax upon himself. Though he may favor the road, he will never be ready just then—he has had a bad crop, or he lost his best horse; another would vote for it if it was located around his farm, instead

of through it, or if it was located through his farm instead of his neighbor's, and so on. I tried it in Missouri, ten years ago. There are one thousand and one objections that will be raised against it, and if it should be voted in the affirmative it would have to be distorted in every shape. It would have to go clear around every corner of Mr. Smith's farm, up and down hills, because Mr. Smith is an influential farmer. It would have to make a two-mile circuit in order to pass by the church up on a hill, or the congregation will kill it, etc. As a result the road would be lengthened 20 per cent., expenses of construction increased 20 per cent., the traffic for a number of years to come would have to suffer for it, the maintenance would have to be paid for that 20 per cent. extra. If, instead of writing an article I were writing a treatise on road building, I would give figures showing the difference in original cost, in travel and on maintenance of a road lengthened 20 per cent. that would astonish some people who have not devoted their time to these studies.

My opinion is that when the proper authority has decided that a road should be build between two points, passing through one or more other points, a careful survey ought to be made somewhat like for a railroad, looking for the straightest line with the best grade and cheapest location. Of course it would be policy not to injure farms unless for a real benefit to the road. Then when the survey should be approved, a law should be passed to order it built, the right of way secured or condemned, the assessments made upon the state, the counties and the property-owners in a certain district through which the road should pass. Then let competent engineers take charge of the construction according to approved specifications.

ARTHUR LAGRON, C. E. Biographical sketch in January number, 1893, page 17.

By no means should the vigilance of the central power stop here. The question of maintenance is of vital importance and should not be neglected. *Arthur Lagron.*

SEWERAGE DISCUSSED FOR THE LAITY.

THE correct sewerage of a city or town upon such lines as will surely contribute to the health and comfort of a community is not always an easy or simple task. Several considerations are necessarily involved in the problem, not the least of which is cost. If no attention is paid to cost of works of sewerage, possibly all other things which are desired could be easily accomplished, but the cost must be ever kept in view, and the difficulty largely lies in attempting sewerage works, which shall certainly be a benefit without making the cost of construction a burden to the people.

Next to cost a difficulty confronts us in so arranging the many branches of a system of sewerage so that each will perform its *pro rata* of the total work, and when sewers are proportioned to carry storm water in addition to sewage, to adjust the grade and size of the sewer for best results with its double office.

Next in importance comes the arrangement of the outfall, main and some lateral sewers, to accommodate an increase of population in the present territory which they are to serve, or to receive the sewage of new territory which may be added to their respective districts.

Whatever additional territory is likely to be added to present districts, or whatever increase in population of the territory now embraced in the districts, must be carefully considered in the original plan of sewerage works, otherwise at some time in the future the works will be found inadequate to the requirements of the city or population, and the deficiency can be remedied only at great cost, and possibly only by a general reconstruction of the system of sewerage as a whole.

If storm water from the usual rain-falls is to be taken care of in whole or part by the sewers, regard should be had for the area, position and general grade or slope and geological character of the territory to be drained, and of the convenience of passing the excess of sewer flow due to the storm water into a neighboring watercourse without risk to health or property of your citizens or neighbors.

Again, it is desirable in proportioning the sewers, to provide for

a certain daily flow through all sewers, at such a velocity that solid matters carried in suspension in the sewage shall have no opportunity to strand and ferment on its way through the lateral, main or outfall sewers to the point of discharge.

There is no danger to health from fresh sewage even though the faecal matter in it from water closets may contain diseased germs, but there is great danger to health if sewage is permitted to deposit solid matter in the sewers, which, unless removed by flushing, will ferment and generate what is generally known as "sewer gases," the effluvia of which is offensive to the senses, while the atmosphere of fermenting sewage may be loaded with the germs of contagious or infectious disease.

Faecal matter when fresh from the person, usually is neutral, but after a short time, perhaps a few hours, an acid condition is developed, and eventually it becomes alkaline, giving off compounds containing ammonia, carbolic acid gas and nitrous and sulphurous acids.

It is not my purpose, save in a general way, to discuss the action of sewers so far as they effect health; you are all aware of the importance of removing from your households and premises all the wastes of the body or of the kitchen, and the problem naturally in your minds is how to do this most surely and at a moderate cost to the community as a whole, and especially to the tax-payers who will be required to pay the principal and interest on the bonds issued for sewerage purposes.

I need not tell you that even in our large cities there are many defective works of sewerage, which are a constant menace to the health of the people, and that the death and case rate for zymotic diseases is invariably greatest in these cities. The same processes which makes a certain small district of India the home of cholera, is always at work in these cities, and in a smaller degree make them the homes of typhoid fever and diphtheria.

But these defective sewerage works in the older cities is largely due to the fact that sewers, a few years ago, were mainly intended to convey away storm water, and incidentally to receive sewage. While to-day the more advanced works of sewerage are mainly intended to rapidly convey away sewage and incidentally to accom-

modate a portion of the storm water which is gathered on the roofs of houses or on the streets and grounds tributary to the sewers.

When sewers were first established in London, no sewage or household or factory waste was permitted to enter them, they were reserved exclusively for storm water, and it is only within the past forty-five years that the London sewers have been used to carry off the kitchen slops, the discharge from water-closets and baths, and the waste water from manufacturing establishments, and it is only within the past twenty-five years that the sewerage system of London has been perfected on sanitary lines; and so well has this work been done (chiefly under the direction of Sir Joseph Bazalgette), that London is to-day, in the matter of zymotic diseases, one of the healthiest of the large cities of the world, and more healthy than many of the smaller towns of this country, where the general conditions of soil, air and water is known to be favorable to health.

The fundamental laws of health, as laid down by Hippocrates 2,000 years ago, and known by all sanitarians to be strictly true to-day, are pure air, pure soil and pure water; lacking any of these requisites the health of a community is imperiled, and proper sewerage and drainage-works will secure a pure atmosphere to breathe and a pure soil to live upon.

It can be readily understood how personal habits will defeat any general efforts to improve the public health; and, upon the other hand, how it would be quite impossible for any individual system of sanitation to ward off the dangers from general unsanitary conditions. But assuming that the mechanical adjuncts of sanitation are duly seconded by personal attention to the laws of hygiene, we will scarcely err in asserting that the most dangerous diseases which beset mankind will be then unknown.

The value of correct sewerage to a city is not limited to the simple convenience in removing the household wastes from the sight or premises, but is far-reaching in its influence on the health of its citizens.

A sewer system on the water-carriage plan (the plan upon which all sewers are built in this country, and the prevailing plan in Europe), contains the laterals, which are the smaller sewers heading in the higher parts of the district, the mains into which the laterals discharge, and if the sewage is discharged at one on several

principal points, the outfall or outfalls which take the sewage from the mains and convey it to the point of discharge, which may be into a running stream or to a sewage farm, or other sewage disposal works.

Sometimes, as in tide-water cities and towns, the original outfall sewers are run by the most direct and convenient routes to the bay or harbor, and the sewage discharged into the salt water, to be diluted and decomposed as best it may, but when (as in Boston several years ago), such a method of sewage disposal becomes a nuisance and an injury to the health of the people, all these separate outfalls are gathered in one or several intercepting sewers, which convey the sewage away from the harbor and city to a safe and comfortable point of discharge.

Cities and towns built on or near running streams at lower elevations, usually discharge their sewage into such streams; but in some states, as Massachusetts, Rhode Island and New Jersey, laws prevail which, in the discretion of the state or local boards of health, prevent the discharge of crude sewage into any stream where it may strand on flats or bars, or where the water of such stream is drawn for public supply at some point lower down.

Improperly designed sewers are sometimes worse than no sewers at all, from the fact that they conceal the danger from our sight, and are therefore not suspected as sources of physical injury. All sewers, whether arranged to carry away sewage or sewage and storm water combined, should, under the most unfavorable conditions of daily service, have such a velocity of flow as will prevent all solid matter in the sewage from standing on its way to the point of discharge, and this can usually be attained by a judicious arrangement of diameters and grades of sewers, by carefully devised junctions of branch sewers with main sewers; and in the case of small laterals, by placing at the head or upper end of each an automatic flush tank, which will periodically discharge into the sewer a large volume of clean water, which rushes down the sewer and sweeps all stranded matter into the main sewers below; and if solid matter, like bricks or stone, find their way into the sewers, repeated flushing will be required to dislodge these and carry them to the man-hole next be-

low the point of obstruction, where they should be removed by hand.

Flush tanks for small lateral sewers are usually built to contain 200 to 250 gallons of water, and to discharge at least once in twenty-four hours. The delivery of this amount of water being effected in a few seconds by means of the automatic siphon built in the tank.

At all changes of grade and direction in sewers of all sizes, and on long reaches at intervals of 300 to 400 feet with the smaller sewers, brick man-holes should be built, the change of grade or change of direction taking place in the man-hole, and between man-holes in all sewers too small to permit of men passing through them from man-hole to man-hole, lamp-holes should be provided for exploring and inspecting the sewers from time to time.

No sewer should be laid at a grade which will produce when running full or half full, a velocity of less than three feet per second, and if the grade is naturally such as to produce a higher velocity than three feet per second, this will always be an advantage, provided the sewer is reduced in area as the grade to which it is laid is increased.

Viewed from the sanitary standpoint, it is desirable that sewers run full or more than half full at least once each day to assist in flushing out solid matter which may stick to the walls or be caught by sand or gravel collected in the bottom of the sewer.

Lateral and some main sewers built on the separate plan have the disadvantage of being too small for proper or convenient inspection, and when given such sizes or diameters as will admit of ready and complete inspection, often becomes too large to be properly flushed with the ordinary run of sewage.

In those cases where the storm water and street washings can be taken by short channels without injury to property or inconvenience to the people into neighboring natural flowing water-courses, it is desirable to construct the sewers to accommodate in addition to the sewage a portion of the roof water, say one-fourth or one-half inch rain-fall per hour, on the roof areas tributary to the sewers, or which as the town builds up may become tributary to the sewers. These small rain-falls on the roof areas can be accommodated wholly in the sewers and, on the other hand, with light summer rain-falls the sewers can be properly flushed. As between six and twelve-inch

pipe sewers the difference in cost is limited to the value to the sewer pipe and laying, trenching, man-holes, lamp-holes, and flush-tanks costing the same for both sizes, and while a twelve-inch sewer properly constructed with man and lamp-holes at convenient distances apart can be easily inspected, a six-inch sewer however well built is a troublesome size for inspection. It must be said, however, that for a given daily or hourly discharge of sewage, and with intercepting traps to arrest heavy solid matters (as brick, bones from the kitchen, old boots, corsets, tin cans, and similar "bric-a-brac"), and keep these from entering the sewer, the smaller sewer will give the best results as a sanitary device; and this is due to the general principle that the more nearly full a sewer is running, provided it be with a velocity of flow sufficient to prevent solid matter in suspension from stranding, the safer it will be to the health of those in contact with it.

Of course, sewers running full will allow no space for currents of air to pass through over the water from one man-hole opening to another, above or below the point of entrance of fresh air, and it might be urged that proper ventilation can not be had with sewers under such conditions of flow, but sewers running full at high velocity leave nothing in them to ferment and give off so-called "sewer gases," and since it is fully established that no danger need be apprehended from fresh sewage, such sewers may be considered safe.

Assume that the distance from a given locality in this city to the point of outfall of sewage into the river is three miles, and the mean rate of flow throughout the whole system of sewers be two feet per second (which should readily be obtained), then the contents of a water-closet in this locality, when discharged into the connecting sewer, will appear at the outfall within two hours and twelve minutes, an interval of time entirely too short to permit of danger arising from the transit of the matter through the sewers. If the sewage traveled at a slower rate, or the sewers are so constructed as to permit of solid matter lodging or stranding in transit, then the whole of this water-closet discharge might never reach the outfall, all or part of the solid matter and some of the liquid matter fermenting in the sewers and giving off noxious and perhaps dangerous gases, poisonous liquids and organic compounds, which may become the pabulum for dangerous disease micro-organisms, which in turn may

be inducted into a susceptible system through sewer gases escaping into or near your habitations.

When a person is dealing with a deadly poison, with a dangerous explosive mixture, or with anything which he sees or knows imperils life or limb, he adopts the usual precautions to insure his own safety and the safety of others; but when we know that there are in defective works of sewerage disease germs as dangerous to the human system as corrosive sublimate, that require to be handled as we would handle gun-powder, that imperils life as much as war, how then can we account for the apparent indifference of people to the disposition of the material (sewage) from which these micro-organisms spring, so long as it is clear of their premises and out of their sight (?) only upon the theory that the danger is more subtle though not less certain than poisons, war or gunpowder, and the lack of general knowledge of the condition of foul sewers, leaves the people in ignorance of danger until some one is stricken with physical disorder and the foundation laid for an infectious or contagious disease, and even then many will doubt the cause of disease because they can not see it working.

It is often held by the conservative citizens that the cost of sanitary works is an obstacle to their construction, but when a great work which will enhance the health and comfort of a community is under consideration too much stress should not be laid upon the cost, for "what will a man not give for his life?" And correct sanitation is life, health and happiness. And correct sanitation the world over means the complete extirpation of cholera, typhoid fever, diarrhœa, dysentery, diphtheria and similar infectious and contagious diseases. And if all communities were equally interested in advancing the condition of their sanitary arrangements, our bodily complaints would then be limited to those due to our personal habits and constitutional defects.

The London sewers are proportioned to take all the sewage and in addition thereto for the six hours of the day when this is a maximum, to receive and carry off a rain-fall equal to one-fourth inch in twenty-four hours.

The sewers of Brooklyn were originally planned to accommodate

in addition to the sewage flow, a rain-fall of one-fourth inch on the whole area tributary to the sewers.

The recent sewers of St. Louis are built to accommodate a two and one-fourth inch rain-fall.

Few sewers are built to carry off excessive floods of storm water owing to the great cost required, and to the fact that excessive rain-falls are rare over any particular area, and are usually of short duration, while rain-falls continuing for many hours are generally not accompanied by a very heavy precipitation, excepting for short intervals of time.

It may be asserted as a proven fact that sewers proportioned for large flow of storm water are practically worthless for sanitary purposes.

In connection with sewerage some attention must be given to the drainage of the sub-soil down to the level of the inverts of the sewers (which we may say will never be less than six and one-half feet below the surface of the street, or one and one-half feet below the footing courses in residence buildings). And this is partially accomplished by the trenching for the sewers, but if the sewer trench is cut in a strong clay soil, no certain reliance can be placed on the back filled trench to act as a sub-soil drain, and recourse must be had to some device which will act through all time. With brick sewers more or less ground water will find its way into the sewers when these are not running full or nearly full, but if the brick ring of the sewer will permit ground water to pass in when the head is greatest outside of the brick work, it will also permit liquid sewage to pass out when the head or pressure is greatest in the sewer, and according to some sanitarians this is to be regarded as a grave danger. The exosmosis of the liquid sewage causes a pollution of the soil or ground about the sewer, and this in time poisons the air in the ground, which may in due time be drawn upon for human respiration; generally, however, the main objection to porous or leaky brick sewer or leaky pipe sewers is the diminution of their capacity by the large amounts of ground water which may pass in and occupy the space originally calculated for sewage.

To obtain a proper drainage of the sub-soil of the district through which sewers may pass, it is preferable to use a separate system of second-class sewer pipe, laid with open joints to the same grade as

the parallel sewer, and to carry the sub-soil drains to the nearest open water-course. There being no sewage admitted to the sub-soil drain, the discharge of the collected water can be made any where without offense or danger to health.

An accurate statement of approximate cost for sewer work can not be stated for any town in advance of a proper study of the topography, areas to be drained and sewered, and of the profiles or profile notes for the respective sewers. *John W. Hill.*

TESTS OF AN ELECTRIC STREET RAILWAY.

THE results that can be accomplished in the power-stations of the smaller electric railways are well illustrated by the following data from the power-house of the Terre Haute Street Railway Company, of Terre Haute, Indiana. The station has a Westinghouse equipment throughout, both in engines and generators, there being one compound, non-condensing engine of 330 horse-power, and two of 130 horse-power, belted to the generators. The log of this station is carefully kept, and as it runs quite uniformly from day to day, the record of a single day is abstracted as a fair average:

Total hours run, operating cars.....17¼.
Total engine hours run.....18.
Maximum number of cars running—
13 cars each having one 15 horse-power, double reduction motor.
2 " " two 15 " " "
7 " " one 20 " " "
Making 22 cars and 24 motors. There were also 7 trailers.
Boilers running, two 54 × 16 ins., 60 horse-power each.
Engines running, one 18 × 30 × 16 Westinghouse compound.
Steam pressure.....110 lbs.
Amperes.....95 to 350.
Voltage.....500.
Car mileage.....1,940.
Coal, bituminous slack (poor quality, evaporation about 4 to 1).
Cost of coal per ton, delivered.....90 cts.
Coal used in 18 hours, including banking.....11 tons.
Cost of coal per car-mile.....51 cts.

A note on the report of this day shows that the weather was hot and dusty, and that the cars pulled hard; also, that the circuit breaker opened an unusual number of times, on account of heavy load. The ampere readings on the record sheet, while indicating occasionally heavy loads, frequently ran quite low, showing that the service was subject to very wide fluctuations, as would be expected with a plant of this size.

CURRENT INFORMATION.

STREET PAVING IN THE NATIONAL CAPITAL.

The country properly looks to the national capital for progressive work in public improvements, and it has really been the source of much valuable information, particularly so with reference to asphaltic paving. Captain G. G. Fieberger, the engineer in charge of public work in the District of Columbia has just submitted to the commissioners his report for the last fiscal year which makes the following showing as to the street paving of Washington:

	City streets. Sq. yds.	Sub'rb streets. Sq. yds.	Total sq. yds.
Sheet asphalt	1,581,982	158,545	1,740,527
Coal tar, concrete and distillate	540,461	.....	540,461
Asphalt block	279,894	966	280,860
Stone block, granite and trap	562,116	23,241	585,357
Rough stone cobble and rubble	308,590	.....	308,590
Macadam	283,056	.....	.....
Vitrified brick	3,921	.....	3,921
Total improved	3,560,020	.....	.....
Total unimproved	1,678,225	.....	.....

The principal changes introduced during the fiscal year were the substitution of a four-inch concrete base for the four-inch bituminous base hitherto laid under asphalt pavements, and the use of vitrified brick gutters upon all streets paved with asphalt.

It is believed that each of these changes will contribute to decreasing the cost of keeping the pavements in repair.

On the subject of vitrified brick, as a paving material, Captain Fieberger says:

"The experiments with vitrified brick have been continued, and have thus far been quite successful. A part of B street north, used as a stand for wagons; a part of 15th street west, used as a hack stand; a party of 1st street west, in front of the District building, are paved with this material. The Georgetown and Tenleytown railroad has used it between the rails and tracks on High street, and during the fiscal year 1894 it is proposed to pave F street northwest from Virginia avenue to 26th street with vitrified brick. The advantages and defects of this material lie between asphalt and granite block."

In reviewing the recent asphalt controversy in Washington, Captain Fieberger says:

"At the opening of the bids for 1893, it was found that the lowest bidder was the Schillinger Paving Company, which proposed to lay the pavements for which we had been paying $2.25 per square yard for $2.05, and those for which we had been paying $2 for $1.99. The samples submitted with the bids were tested by the inspector of asphalt and cements, and were reported unsatisfactory. At the request of the bidders I visited the works of the Trinidad Asphalt Company at Jones' Point, New York, from which the Schillinger Company proposed to obtain its supplies. Samples from all the cargoes at these works were again tested by the inspector of asphalt, who reported them land asphalts, and inferior to the Trinidad Lake. The best cargo approached so nearly the Trinidad Lake in quality that the commissioners decided

to award the contract to the Schillinger Company for one street to be paved with this cargo.

"The company, however, failed to enter into its contract within the specified time and the bid was accordingly rejected. At the opening of the bids for work for the current year it was found that Mr. Thos. H. Thomas, of New York, was the lowest bidder. He was 85 cents per square yard lower than the Barber Company for asphalt pavement upon a six-inch concrete base, and 35 cents per square yard lower upon a four-inch base. His prices were $2.10 for the former and $1.90 for the latter.

"Samples of the asphalt submitted by him were examined by the inspector of asphalt and cements, who reported that he did not think it advisable to accept the bid and experiment with a new material.

"At the request of Mr. Thomas further investigations were made, and I visited the refining works at South Amboy and a pavement made with this material in Detroit, Michigan, in October, 1892. Further experiments were made in the District laboratory by Prof. Richardson, chemist for the District and by Profs. Bowen and DeSmedt, chemists for the two competing bidders.

"The laboratory experiment did not seem to give any decided advantage to either of the asphalts, the results being differently interpreted by the various interested parties.

"The pavement laid in Detroit having proved about equal to the Trinidad Lake asphalt laid the same year, it was decided not to reject the bid entirely on account of the material. Mr. Thomas having convinced the commissioners of his ability to carry out any contract entered into by him, and as the work done by him was to be superintended by Prof. De Smedt, who has been for several years inspector of asphalts and cements for the District, he was finally awarded a contract for paving about 20,000 square yards. At the present time his work in Washington has been completed, and he is engaged in carrying out his contract. Time alone can demonstrate whether his pavements are equal to those laid with the Trinidad Lake asphalts."

CHEAP STREET PAVING IN SAGINAW.

The streets of Saginaw, Mich., are largely paved with sapless cedar blocks laid on a sand and board foundation, with cobble-stone gutters or curbstone. Mr. R. W. Roberts, the city engineer of Saginaw, in his last annual report just issued, says of this kind of paving:

"A cedar block and cobble-stone pavement, with sixteen feet of cedar in the center of the street and seven feet cobble-stone gutter on each side, seems to be the kind of an improvemont most generally accepted by the property owners on resident streets. This kind of a pavement is cheap in first cost, reasonably durable, noiseless and clean.

"During the past season three streets have been permanently improved with a macadam pavement, one thirty feet wide, and curbed with curb stone, and two with macadam, eighteen feet wide, with a six-foot cobble-stone gutter on each side without curb stone. The macadam was composed of broken stone, broken to a size of from one inch to two and one-half inches in their larger dimensions, placed on the sub-foundation, sufficient to make twelve inches in depth when thoroughly consolidated by rolling. Upon this surface is placed sufficient stone screenings or fine gravel

to fill the interstices and bind the top surface.

"This kind of an improvement is very durable, with proper care, and for moderately traveled resident streets is one that can be laid and maintained probably cheaper than any other improvement that can be put down in this city.

"There are many of our resident streets, when pavements are desired, that can be improved by subdraining the road-bed and placing thereon a thin coating of broken stone and consolidating it with the steam roller, which will give to the street all the advantages of a more costly pavement for about twenty per cent. of the cost of a macadam or cedar block pavement. Such an improvement should be made in place of planking streets, and it will be found to relieve the highway funds of a large expense in maintaining plank streets. Our soil is such that if kept dry it is one of the best kinds of material to drive over, and all we need in our dirt streets, when the travel is not heavy and concentrated, is sufficient broken stone over the traveled portion of the street, which is not to exceed twelve to sixteen feet on streets. I have in mind to keep the clay sub-foundation during the fall and spring months when the ground is wet."

Mr. Roberts recommends that repaving should be done on a concrete foundation, no matter what the wearing surface is. He says: "Let the property owners choose as to that, but the board of public works should insist on a permanent foundation."

ASPHALT AND ROADMAKING

The general utility of this substance has long been recognized, and in all well-conducted cities it is indispensable. Its commercial uses are many, but its adaptability for building purposes and its worth as a roadmaker make it especially valuable. Of a viscous nature, it readily coheres with any hard substance that may be introduced. This coherent quality enhances its value to outlying townships particularly as to roadmaking, for it can be mixed with any substances locally plentiful, such as sand, gravel, broken stone, etc., to a harder or more desirable consistency.

It is significant that in America, with the general commercial extension, there has been much neglect of the roads. Leading to and even in large manufacturing and commercial centers there are to be found roads which in dry weather baffle the strongest team. In wet weather they are impassable even to unloaded trucks. In farming districts they are deplorable. To have roads in such a state is undoubtedly the falsest economy. In European countries much advance has been made in the last century toward improvement of those vehicles of the industrial communities with much saving. The farmer there has awakened to the fact that the cost to maintain extra freight cattle and the wear of carts, etc., together with the loss of time and the trouble is greater by far than the tax imposed for the proper upkeep of the road. In fact to computate the loss involved by bad roads would be almost impossible, both as to the shortening of life and as to the reduction of the value of property—stationary, movable and perishable.

In the *Century Magazine* for October, Mr. William Fortune gives an account of the various methods commonly in vogue in roadmaking. This article, entitled "Street-paving in America," is interesting, inasmuch as it shows the various

styles and their defects. Under the subcaptions "Foundations," "Granite or Stone Blocks," "Paving," "Wood Blocks," "Street Pavements" and "Paving Brick and Their Use," there is much that can be learned and much shown to avoid. But here we are not dealing with the many ways of forming roads, but in the usefulness of asphalt, which Mr. Fortune describes under "Street Pavements." While "all street pavements can not properly be called asphalt pavements," yet any reader can see that asphalt is a substance which is specially designed for paving, more especially where "travel is comparatively light." While as yet we find asphalt paving too prone to climatic extremes, there is no doubt but that experiment and manipulation will overcome these defects. Such compositions require to be carefully handled, and it is well known how the contractor, for enhancement to his pocket, and the careless workman sink the value. "The tendencies of the mastic composition to disintegrate in places where the surface soon wears away" is certainly carelessness, and "the only safe assurance of durability is an adequately protected guarantee, at the time of construction, that they may be kept in good condition for a fixed period of time" is very protective against carelessness.

Where the roads are bad perfection can not be expected all at once. Indeed, there is hardly any road considered perfect. But there is no reason why they should not be improved. Where it is necessary to support heavy and constant traffic as in cities the granite blocks seem to be essential, of course, backed up by a strong foundation matrix. But where the traffic is not overheavy or over-continuous as in most parts of this country, an asphalt composition can be made very good for all practical purposes. Eighth avenue in this city is sheet-paved on both sides to the car rails, and there is a very general traffic, in some part rather heavy, yet it withstands the pressure admirably. The system of throwing down *debris* on the soft soil to strengthen or make a road only adds to the general unevenness. In places not yet fully built up it will be found in the end to be very much cheaper to thoroughly organize a system for the maintenance of the roads.

J. S.

New York, Nov. 1, 1893.

MINNEAPOLIS ALDERMEN NOW FAVOR BRICK.

The Minneapolis aldermen who are endeavoring to solve the paving problem for that city are still continuing their investigation. Several official representatives of the city recently visited the paving brick works at Galesburgh, Ill., and it is now reported that nearly all of them are strongly in favor of using brick in the streets of Minneapolis. They believe that they have in the vicinity of Minneapolis clay of the requisite qualities for making good paving brick.

In speaking of the visit of the Minneapolis party to that city a Galesburgh paper says:

"There is room in the valley east of the city for many times the capital now invested, and there is absolutely no limit to the demand that will follow the growing appreciation of the superior adaptability of brick for general paving purposes over any other material known. Our paved streets are the best advertisement of the paving brick, and it would be a grand scheme for the city and the paving brick factories to jointly arrange a series of

excursions which the officials of all cities and towns, near or remote, contemplating improving their streets, should be invited to avail themselves of. The details of this plan could easily be arranged, the railroads, which would benefit largely in freights, would be found liberal in terms, and committees on invitation and reception would properly care for the visitors."

Alderman Loye, of Minneapolis, in speaking of his observations while in Galesburgh, said in an interview:

"I must confess that I left home strongly opposed to brick paving, but I have changed my mind since I came to Galesburgh and have seen your beautiful streets. I think it is just the thing, and shall now go home and advocate the use of brick to our people. So well pleased have I become that I have secured a brick that has never been used, and have also secured one that has been down for the past ten years, and shall take them home to show our people. In fact, I can not see that the brick that has been in use for ten years is worn any more than the one that has never been in use. What I am now in favor of doing is to have two or three car-loads of brick sent to Minneapolis and have the intersections of some of our main thoroughfares paved, so that we can get a good test of the wearing qualities of the brick. This will do more to win our people over to this mode of paving than anything else."

WORK FOR THE UNEMPLOYED.

The present condition of affairs has aroused to action the citizens of Kearney, Neb., who evince deep interest in anything that will lead to a solution of the perplexing ques- of furnishing employment for their unemployed during the winter. The business streets of the city need paving, and those interested in providing labor for the poor urge that they be paved at once, and that the county repair its roads and undertake any other needed improvements. The per cent. of unemployed labor is not greater in Kearney than in any other city of its size, and this movement for their benefit is one that has received consideration in many cities and towns. The poor in Indianapolis have never planned for their own welfare as the labor relief committee of the Commercial Club is planning for them now, and with results that are daily improved upon and made more satisfactory. Registration quarters have been opened for them, where they are required to call and answer questions asked them, in order that the committee may give them help. Citizens only are supplied with work, and the heads of families are given first preference. When the questions have been answered satisfactorily, a card is given them, telling them where and to whom to apply for work. This relief committee, composed of Messrs. H. H. Hanna, Eli Lilly and William Fortune, has been made the medium of every organization in the city, so that no mistakes may be incurred and all may share alike the opportunity offered for relief.

BRIDGES IN THE DISTRICT OF COLUMBIA.

There are sixty-five bridges within the boundaries of the District of Columbia. Their aggregate length is about thirteen and one-half miles. Nearly all of these bridges have been constructed with special reference to economy; as a result they compare very unfavorably with the other public works of the District. Many of them are old wooden struct-

ures, which require constant repair, and should be replaced as soon as possible with more modern structures of metal or masonry. Capt. Fieberger, District engineer, urges the replacing of the navy yard bridge with a new structure, at an estimated cost of $250,000. The regulations relating to the passage of vehicles over all bridges have been modified so as to allow light vehicles to cross most of the bridges at a speed of six miles an hour instead of at a walk, as hitherto required.

STREET RAILWAY TRACKS ON PAVED STREETS.

City Engineer Roberts, of Saginaw, Mich., says that it has been demonstrated by the use of electric motor cars on the paved streets of that city that pavement can not be maintained in good condition for any length of time, while electric motor cars are run on a flat light rail laid on longitudinal timber or stringers resting on ties ballasted with an insufficient amount of sand and gravel, upon a sub-foundation poorly drained. The frequent loads on the tracks and their settling disturb the foundation under the pavement, causing the paving blocks to become loose and rise above the rails of the track. The greatest damage resulting from this, Mr. Roberts thinks, is the forcing of water under the rails and foundation of the track out under the pavement on either side so that it loosens the entire foundation, and the pavement soon begins to yield under ordinary travel. He believes that the premature destruction of pavements in streets where electric street car lines are operated is due largely to the poorly constructed track and foundation. He recommends that hereafter all street car tracks be laid on a foundation of six inches of concrete or eight inches of broken stone, with such surface and sub-drainage as will at all times conduct the water quickly and freely from the tracks and foundation.

UNDERGROUND STREET RAILWAY WIRES.

There is now in successful operation in Washington, D. C., a double track electric street railroad, on U street N. W., from Seventh to Eighteenth street, with underground wires. Though somewhat more expensive to construct, Capt. Fieberger, the District engineer, says that it has all the advantages of the ordinary overhead trolley, with the additional ones of having no objectionable and dangerous overhead wire, and a protection of the gas and water pipe by the use of a return wire. Having many advantages over the cable and other electric systems, it is to be hoped that the future will see a considerable extension of this or some similar system.

BALTIMORE'S GOOD SEWERS.

A report on the sewers of Baltimore, Md., has been submitted by Mr. Rudolph Hering, who highly commends the character of the sewer work in Baltimore, as follows:

"My inspection of several of your sewers now being built, viz., two sections of what was called the Bush street sewer, and the outlet of the North avenue sewer, showed me that the construction was of excellent character. In fact, I am much pleased to say, and you must be pleased to hear, that nowhere in our country have I seen better work. The materials, so far as their appearance is concerned, were very good, and the workmanship was characterized by a neatness and

undoubted indication of carefulness, which disarms any unfavorable criticism in that direction. I may add at this place that I should, therefore, expect the cost to exceed that of some of the sewer work in other cities, where it is not as neatly done nor with such ample dimensions of walls, etc. I am particularly pleased to see that attention seems to have been given to the interior surface, for I have always emphasized the importance of this for sanitary reasons, because a smooth and regular interior surface greatly prevents the retention of foul matter, allowing it to decompose and to cause objectionable odors."

SANDSTONE FOR PAVING.

The Minneapolis *Journal* says that the council committee on paving in that city regards with some favor a proposition from property owners on Hennepin avenue, between Third and Fourth streets, to pave that block, and both intersections, with Minnesota standstone, similar to the stone used in many places in Minneapolis for curbing. The sandstone can be sawed into blocks, larger, but shaped like the ordinary vitrified paving brick, with beveled edges and a smooth surface, and it is said will be a more level and a less noisy pavement than brick. If laid on sand, as proposed, the total cost, in the opinion of Ald. W. B. Woodward, chairman of the committee on paving, ought not to be more than about $1.50 per yard. The claim is made that the sandstone will wear well, that it will not become smooth and glossy, and, therefore, slippery, and that it will last almost as long as the best grade of granite.

"I am very favorably impressed with the suggestion," Mr. Woodward said in an interview with a reporter of the *Journal*, "and hope the experiment will be made. As I understand it, the block that will be laid now will not cost the city a dollar unless it proves to be first-class in every way and just what is claimed for it. The proposition to do this paving comes from the best-known owners of real estate on Hennepin, between Third and Fourth, and for one I am desirous that the trial be made. The city loses nothing either way, and, if the experiment succeeds, we get a good pavement at a very reasonable cost."

WHAT GRAND RAPIDS HAS DONE.

The twentieth annual report of the board of public works and the city engineer, H. A. Collar, of Grand Rapids, Mich., show that 130 miles of the streets of Grand Rapids have been paved. According to this statement one-half the total length of streets in Grand Rapids have been paved. This is a very creditable showing. The board of public works made expenditures for public improvements during the last year as follows: For streets and alleys, $301,316.88; for sewers, $110,337.60; for water-works, $108,170.14. Total, $519,824.62. During the year City Engineer Collar established grade lines on twenty-eight miles of streets. He says that Grand Rapids now has seventy-one miles of sewers.

ASSOCIATION OF ENGINEERS OF VIRGINIA.

An informal monthly meeting of the association was held November 15, 1893. The subject for the evening was "The Slide Rule and Similar Aids to Calculation." The discussion was opened by Mr. M. E. Yeatman, who explained the prin-

ciple of the plain slide rule, the method of use, with numerous examples. He followed with an explanation of the advantages to be gained by a circular slide rule, arising from its greater length of graduation, and explained the method of making it and using it, giving many illustrations. Thacher's cylindrical slide rule, having an effective length of scale of thirty feet, was next explained fully, with examples showing the manner of using it. Mr. Yeatman closed by giving a comparison of the accuracy of the three types of slide rules as follows:

The plain slide rule ten inches long gives results accurate to within one part in 216 parts.

The circular slide rule eight inches diameter gives results accurate to within one part in 1,080 parts.

The Thacher cylindrical slide rule gives results accurate to within one part in 15,400 parts, assuming in each case that graduations can be read to within 1-100 of an inch.

Mr. G. R. Henderson presented to the club a specimen of logarithmic or cross-section paper, and explained its application to the graphical solution of any formula having the form $y=bx^n$. Every such equation can be reduced to a logarithmic equation of the first degree as follows: $log.\ y=log.\ b+n\ log.\ x$; and, therefore, when plotted on logarithmic paper, it appears as a straight line. The solution of such an equation is readily obtained by simple inspection. He illustrated the application of this paper by showing a straight line giving by inspection the ordinate of the parabola $y^2=4x$, and the hyperbola $xy=10$. He showed the practical application in the determination of the safe load on spiral springs and their deflection under given loads. P=tons safe load on a spring=$\frac{80000\pi d^3}{16\ R}$ where $\pi=3.1416$, d=diameter of wire, and R radius of coil in inches. Deflection with one-ton load for spring 100 inches long equals $0.17\ \frac{R^2}{d^4}$. This paper is designed by W. F. Durand, of Cornell University, and is manufactured by Andrews & Church, of Ithaca, N. Y., costing sixty cents per quire, the sheets being eleven inches square.

The discussion was joined in by R. de Saussure, R. H. Soule, C. C. Wentworth and H. Gillis. Mr. de Saussure explained the application of the logarithmic spiral curve to the same uses as the slide rule.

Next monthly meeting, Wednesday, December 20, 1893, 8 P. M. Subject: "Sewage System of the City of Roanoke."

L. J. CARMALT, Sec'y.

Roanoke, Va., Nov. 18, 1893.

BETTER SIDEWALKS IN WASHINGTON.

During the last year about 10,000 square yards of old brick sidewalks in Washington were replaced with granolithic, cement, asphalt and cement tiles. The granolithic walk is the one generally preferred by the property owners, and is now laid for $1.73½ per square yard. This pavement consists of five inches of Portland cement concrete. The material used in the surface layer, which is one inch thick, is finely broken blue stone clippings. This pavement represents an even surface, but it is difficult and expensive to repair. The asphalt tile walk is made of compressed hexagonal or square blocks laid in a bed of sand. The present cost in Washington is $1.50 per square yard. This pavement has the advantage of being easily re-

paired. The walks of ordinary paving bricks laid during the year cost about 70 cents a square yard.

PERMITS FOR STREET OPENINGS.

A general ordinance regulating the paving of streets and macadamized roads was favorably reported by the council's highway committee, November 8, at Philadelphia, Pa. The ordinance provides that "before a permit shall be issued to any person, railway or other corporation to re-open a paved street, a sum equal to twice the cost of repaving an approximate number of square yards at $3 per yard shall be deposited with the city treasurer, or ample security furnished for the restoration of the paving torn up." An amendment, reducing the fee from $4, which plumbers are required to pay for the privilege of opening a street, to $2 was agreed to.

SLAG AS A SUBSTITUTE FOR STONE.

A suggestion has been made by Robert Burton at Butte, Mont., that slag from the smelters will make a good substitute for stone as a paving material in that city. He says that the slag can be broken as readily as the stone, and if broken into reasonably small pieces, with a top dressing of sand, it will, after a little traffic has passed over it, become a compact pavement that will withstand wear. Mr. Burton wants the street commissioner to experiment with it.

BALTIMORE'S STREET PAVING COMMISSION.

Under authority of the city council of Baltimore, Md., there has been appointed a commission which will be known as the Baltimore Street Paving Commission, to investigate the question of street paving. Hon. James Hodge is president of the commission.

THE LOS ANGELES WATER-WORKS.

Some months ago R. B. F. Peirce and J. C. Shaffer, of Indianapolis, purchased the Los Angeles city water system. They paid $2,500,000 for the system, and the city is now trying to gain possession of it, and are taking active steps in trying to learn what sum of money the gentlemen will accept for it. It is thought that the price once mentioned by Messrs. Peirce & Shaffer, $3,300,000, will be accepted.

PERSONALS.

Mr. Albert Haskell was elected superintendent of the Auburn Water-works, November 6, at Auburn, Maine.

Mr. Eli Whitney was unanimously elected president of the New Haven Water Company, November 9th, at New Haven, Conn.

Mr. J. F. Witmer, Buffalo, N.Y., has been engaged to prepare plans and superintend the construction of the water-works plant at Greenfield, Ind.

Mr. Alexander Potter, associate member American Society of Civil Engineers has, during the summer, superintended the construction of water-works systems in fifteen cities.

At the regular meeting of the Civil Engineers' Society of St. Paul, on November 6th, Major J. W. Howard, of the Barber Asphalt Paving Company, delivered a two-hour lecture on "Asphalt: Its Chemistry, Sources and Uses."

Mr. Andrew Rosewater, city civil engineer at Omaha, Neb., protests that one of the four sewer flushers being experimented with at First and South Fifteenth streets, Denver, Col., is an infringement on his patent. The flusher in question is a Denver contrivance.

MACHINERY AND TRADE.

RECENT INVENTIONS.

A Wheeled Scraper. 506,212. Patrick Deevy, Hansen, Neb. This invention comprises a cranked axle, a shovel or scoop depending therefrom, an operating lever, and links connecting the operating lever and arms of the axle and adapted to operate successively in communicating motion from the former to the latter.

Composition of Matter for Water Pipes. 506,356. Eugene F. Badgley, San Francisco, Cal. This invention consists of asphaltum or bitumen, pulverized clay, magnesia and asbestos.

An Apparatus for Treating Garbage. 506,361. Assigned to the American Incinerating Company, Philadelphia, Pa. This invention comprises a chute provided with a grate, a pulping and compressing appliance, an inclined plane, a centrifugal separator and drier, an endless conveyer, a furnace, a disinfecting and agitating appliance, suitable connections and means for operating the pulping and compressing appliance, separator, drier, conveyer and agitating appliance.

An Apparatus for Pulping and Compressing Garbage. 406,362. Assigned to the American Incinerating Company, Philadelphia, Pa. This invention comprises a main frame provided with base and top pieces, brackets carried by the top pieces, and provided with ways, standards secured to the base pieces, a hopper carried by the brackets, squeeze-rolls journaled in blocks working in the ways, calender-rolls journaled in blocks working in ways in the standard, a conveyer for receiving the material discharged from the squeeze-rolls and for conducting the same between the calender-rolls, an evener for distributing the material upon the conveyer, and means for driving the rolls and conveyer.

Process of and Apparatus for Treating Garbage. 506,363. Assigned to the American Incinerating Company, Philadelphia, Pa. This invention consists in disinfecting the garbage or refuse matter, separating the solid from the liquid matter, squeezing, pulping and compressing the solid matter, and incinerating the same and disinfecting the separated liquid matter.

A Street Sweeper. 506,701. Bernhardt Kraph, Philadelphia, Pa. This invention comprises a wheeled platform, a transversely extended dirt receiving compartment depending therefrom and having a rear opening facing the brushes, a guiding plate pivoted to the lower rear edge of the dirt receiving compartment, brushes adapted to co-act therewith to deliver the dirt through the opening, inclined passages extending upwardly from such dirt receiving compartment and communicating with each other at their upper ends, a discharge opening in one of the passages, a transversely movable receiving bucket normally in position beneath the discharge opening, and a conveyer extending from the dirt receiving compartments through the passages.

A Street Cleaning Machine. 506,809. Assigned to Richard Lawrence, Malcolm, Melbourne, Victoria. This invention comprises a series of elevating buckets supported upon a pair of traveling chains, a curved plate of concave

supported at the rear of the machine, together with a series of scrapers arranged to project beneath the lower edge of the curved plate or concave.

Manufacture of Artificial Stone. 506,847. Aaron H. Frear, Washington, D. C. This invention consists of an aqueous saccharine solution of litharge, and alkaline solution of shellac, an aqueous solution of glue, and an aqueous solution of ocher hydraulic cement, sand or gravel, gypsum or plaster of paris and a metallic oxide.

A Method of Sewage Disposal. 506,880. Ira H. Jewell, Chicago, Ill. This invention consists in subjecting the sewage to a suitable filtering medium within a suitable receptacle and then volatizing or causing the combustion of the solids and impurities arrested by the filtering medium without removal from the receptacle.

A Street Sweeper. 507,628. Henry S. Moody and Fred R. Smith, Omaha, Neb. This invention comprises a carriage, a supporting frame, a fan spout below the frame, a fan above the frame communicating with the spout, a brush hood telescoping within the fan spout, a brush within the hood the shaft of which projects beyond the hood, a sprocket upon one end of the shaft, bars pivoted to the supporting frame, the lower ends being adapted to contain the projecting shaft ends, rods loosely working upon the broom shaft, levers for raising and lowering the rods, an electric motor in sprocket and chain connection with the broom and fan, and a dust collector connected to the fan.

A Non-conducting and Water-proof Cement. 507,662. Napoleon D. Menegal, Leadville, Col. This invention consists of white clay, yellow ocher, iron filings, cocoanut fiber, wool, flour, charcoal and lubricating oil.

A Pavement. 507,683. Wilmot Lake, Charlton Heights, Md. This invention consists of a pavement having a hydraulic cement base, and an upper course or layer of concrete, and a bonding course of broken stone imbedded into the cement base and course of concrete, with their upper ends covered by and standing some depth below the upper surface of the course of concrete.

A Street Sweeper. 507,719. Charles Z. O'Niel, New York, N. Y. This invention comprises a rotary axle, a rotary broom, gearing to drive the broom from the axle, a clutch included in the gearing, a rock shaft and intermediate means to raise and lower the broom, an operating lever fixed to the shaft, a clutch-shifter comprising a fork to engage the sliding member of the clutch, a horizontal arm, a vertical arm extended upward near the path of movement of the lever, guide bars for the horizontal arm, and a cam actuated by the lever to move the clutch shifter.

A Compound for Artificial Stone. 508,033. Aloys Mohle, Malstatt, near Saarbrucken, Germany. This invention comprises sulphuretted slag, brick dust, waste sandstone, sand, cement and carbonate of soda.

V. H. Lockwood, Patent Att'y.

Indianapolis, November 20, 1893.

ECONOMICAL EXCAVATION IN SEWER BUILDING.

The problem of reducing the enormous cost of excavating sewer trenches having a depth which necessitates the handling of excavated material by means of staging or scaffolds in the trench has been one on which a great deal of time

MOORE'S HOISTER AND CONVEYOR IN OPERATION ON EAST SIDE TRUNK SEWER, ROCHESTER, N. Y.

and money have been expended in recent years. Investigation will show that where excavated material is handled over and over again out of a trench that the cost of so doing is somewhat similar to that of shoeing the farmer's horse at "one cent for the first nail, two for the second," etc., increasing in a manner that has caused many a lively and unpleasant surprise to contractors who have entered into contracts without an adequate knowledge of the cost of such excavation. The objections to this original system are manifold, among them the primary item of enormous cost per cubic yard excavated, the increased cost of timbering the trench, the blockading of streets and sidewalks, the annoyance of handling material, not to say the almost impossibility of doing so in certain cases, but nevertheless this method of excavating deep trenches is still largely practiced. Several devices have been used by the more progressive contractors engaged in this business to reduce the cost somewhat, but most of them are objectionable. Guy and stiff-leg derricks are used where there is ample room for the swing of the boom and storage for surplus material. The objection to this method is the expense of taking down and resetting those derricks as the work progresses. It is impossible to use them in narrow trenches or narrow streets. Another device is the steam traveling derricks. They weigh from ten to twenty tons, and work directly over or upon the side of the trench, and are used to back-fill by carrying the loaded buckets to the end of the trench and dump the contents upon the completed work. The wisdom of working ten to twenty tons of machine on the side of a trench with one ton of load for the purpose of back-filling, is questioned. They also require great care in laying track, and frequently break down when needed most. The objection to them is that they are unreliable and break down the sides of the trench, even in hard material. Suspension cableways have been used, but have proven unsatisfactory on account of the great expense in moving and erecting them, which causes a delay of not less than two days and sometimes weeks to effect. Several other devices have been used, some with ordinary dump-cars running along the side of the trench, which are loaded and moved to the end of the trench and the contents dumped off on the completed work.

All of these methods have objectionable features even to their designers, and have been used as temporary makeshifts, their only merit being that they were better than hand labor. The peculiar conditions governing the operation of machines devised to assist in excavating trenches for deep sewers, are such that it has been extremely difficult to design anything that would make a creditable showing. The braces used in timbering a trench formed obstacles to many an otherwise worthy device, as, also, the different kinds of soil; while in rock excavation none of the devices before mentioned have been able to give any satisfaction whatever, as the heavy blasting rendered their operation useless. In short, the conditions are such that progressive contractors engaged in this business are waiting for something that will entirely overcome those difficulties, and render the business of sewer construction one that can be definitely figured upon a certain paying basis, and which removes all of its difficult complications. They need wait no longer. There is illustrated in this issue an un-

equaled sewer machine, the invention of Contractor Thos. F. Moore, of Buffalo, N. Y., known as Machine No. 4, "Moore-Hoister and Conveyor," whose workings on the East Side Trunk Sewer, of Rochester, N. Y. (a million-dollar job), is simply marvelous. This machine has been working on the largest sections of this sewer in the past twelve months, at depths of from eighteen to twenty-seven feet. The average width of the cut was twelve feet, and the excavation was composed of from five to eighteen feet of solid rock, extending a total length of two miles. It has withstood successfully the heaviest blasting with impunity, at a cost of absolutely nothing for repairs. The working length of this machine is 300 feet. It is mounted on two parallel rails on the sides of the trench, having a gauge of fourteen feet.

This machine has in twelve months' time hoisted and conveyed to the end of the advancing trench approximately 45,000 cubic yards of rock and boulders and 27,000 cubic yards of earth measured in the cut. At twenty-five working days per month this means a continuous average of 280 yards per day. It has a record of hoisting and conveying ten loaded buckets of thirty-five cubic feet capacity each from the bottom of the trench to the end of the machine over the completed work, dumping the contents thereon and returning them to the bottom of the trench for the purpose of refilling, in eight minutes and twenty seconds. This is at the rate of 943 cubic yards per day and stands unparalleled. This machine is constructed entirely of steel. Mr. Moore's machines have been used exclusively heretofore in New York state, but Mr. Wm. Bos sert, of Indianapolis, Ind., has secured one for work on his contract for a trunk sewer in that city. The efficiency of this machine is undisputed and it may be recommended to sewer builders. Additional information regarding the machine is given in Mr. Moore's advertisement elsewhere.

CONSOLIDATION OF PAVING BRICK COMPANIES.

The stockholders of the Purington and St. Louis paving brick plants met at Galesburgh, Ill., November 8, and consolidated. The principal stockholders are: D. V. Purington and G. C. Prussing, Chicago; E. C. Sterling, St. Louis; N. B. Owen, Hobart, Ind. The capital stock was increased from $450,000 to $500,000. The name of the Purington Paving Brick Company will be retained.

CONSOLIDATION OF SEWER PIPE COMPANIES.

All of the sewer pipe manufacturing companies of the Upper Ohio Valley were merged into a joint stock company, October 27th, to be incorporated under the laws of the state of Ohio. The companies included in this consolidation are: Knowles, Taylor & Anderson, East Liverpool, O.; Calumet Fire Clay Company, Calumet, O.; Empire Fire Clay Company, Empire, O.; Great Western Fire Clay Company, Toronto, O.; Markel Sewer Pipe Company, Toronto, O.; P. Connor, Toronto, O.; McMahon, Porter & Co., New Cumberland, W. Va.; Freeport Fire Clay Company, Freeport, O. The capital stock of the new company will be about $750,000.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Milan street, New Orleans, La., is being paved with Rosetta gravel.

Ashland, Wis., now has five and a half miles of cedar block paving.

A final estimate of the new pavement at Ionia, Mich., places the total cost at $10,363.17.

Asphaltic pavements have been laid in Straight street and Fairview avenue, Cincinnati, O.

The paving of South Fourth avenue, Mount Vernon, N. Y., is completed at a cost of $28,216.58.

The paving of Kinsman street, and Payne and Logan avenues, Cleveland, O., is progressing nicely.

Simms street is undergoing improvements that will make it one of the finest driveways in Cadillac, Mich.

The new brick pavement on North Vermillion street, Streator, Ill., is said to be the best street pavement in that city.

Eugene Kirk, Youngstown, O., writes that the paving of Elm street, Glenwood avenue and Federal street is completed.

Winona, Minn., expended $118,551.59 during the summer for brick paving and curbing, which has proven very satisfactory.

Since the organization of the street and water board at Newark, N. J., four hundred thousand dollars has been expended for street pavements.

The brick pavement recently completed in Washington avenue, Newport, Ky., is considered the finest in that city. Chas. Spink and Son had the contract.

If the contemplated plan of paving the Dayton (O.) and Eaton pike is acted upon, a continuous driveway of asphaltic pavement, six miles in length, will be realized.

Monmouth, Ill., has more than five miles of fine street paving. West Broadway, which was completed last month was the last contract let by the city council for this year.

The contract for the asphaltic paving of Fort street, Detroit, Mich., has been completed. Great satisfaction is expressed with the work and the character of the pavement.

H. A. Collar, Grand Rapids, Mich., writes that owing to the season being so far advanced, no more paving contracts will be ordered now, but the outlook for paving in the spring is very promising.

The council at Bellefonte, Pa., is experimenting with vitrified brick for street crossings, the brick being placed between strong stone curbs. Much satisfaction is felt with the experiment, the crossings being pronounced strong and durable.

The Warren-Scharf Asphalt Paving Company was, November 4th, relieved of any further obligation in the Bartlett street paving matter, at Toledo, Ohio. In the minds of those familiar with the case, there seems to have been no question but that the Warren-Scharf Company was right.

Cyrus T. Long, city engineer at Greensburg, Pa., gives a tabulated statement of paving completed in that city during the summer, which shows a total of 3,898½ lineal feet of street paving, 6,889½ cubic yards of grading, 8,303½ feet of curbing, 12,641 8-9 square yards of brick. Total cost, $24,139.94.

The new pavement on South Fitzhugh street, Rochester, N. Y., has been completed. It was designed by City Surveyor McClintock, and is made of trap rock, with a covering of Portland cement. It is pronounced smooth, cleanly and economical, and if it proves durable, much credit will be entitled Mr. McClintock.

About twelve miles of streets have been paved in Dayton, O., during the summer, making, roughly estimated, about eighteen miles of paved streets in that city. The advantages of well paved streets are duly appreciated by business men and citizens, and the work will be carried forward more extensively next year than it has been heretofore.

A stone pavement is being laid on Second street, in Milwaukee, Wis., at a cost of $3.21 per yard. The foundation consists of 6 inches of concrete, covered with two inches of sand. Seven-inch granite blocks are laid on top of this, the interstices of which are filled with hot sand and paving cement. The satisfaction with this pavement is so great that similar pavements will be constructed in the lower part of the city where traffic is heavy.

About $300,000 has been expended in Duluth, Minn., during the past year, for public improvements. All of the paving contracts will have been completed but one, which will be carried over until 1894.

Mr. Wm. Ficklen has been negotiating with the city officials at Rock Island, Ill., with a view to securing the contract for paving Twenty-third street, so that he may introduce a curbing of cement composition which is handled by his firm. Fifty miles of this curbing has been placed along the boulevards in Chicago and presents a nice appearance.

CONTEMPLATED WORK.

A new highway will be constructed from Southington to Waterbury, Ct.

A brick pavement will be constructed on Franklin street, Lancaster, Pa.

An asphaltic street pavement is contemplated on Elmira street, Williamsport, Pa.

Norwich, Ct., has voted $8,000 for the purpose of constructing a permanent stone road.

Eighteen hundred feet of Spring street, Windsor, Ct., will be macadamized at an estimated cost of about $2,000.

The citizens of Cleveland, Ohio, are agitating the construction of a boulevard between Wade and Gordon parks.

Washington street, Toledo, O., will be paved with vitrified brick from Collingwood avenue to Lawrence avenue.

The mayor and city council at Jerseyville, Ill., have taken action with a view to paving State and Pearl streets with vitrified brick.

The city council at Moline, Ill., adopted ordinances for the paving of Third avenue, Thirteenth, Sixteenth, Eighteenth and Fifteenth streets.

Pennsylvania avenue, Tyrone, Pa., will be paved with vitrified brick at a cost of $2.18 per square yard and 70 cents per lineal foot for curbing.

North street, Middletown, N. Y., will be repaved next spring. The material has not been fully decided upon as yet, but the choice lies between asphaltic blocks and vitrified brick.

At a meeting of the property-holders on Marcus avenue, St. Louis, Mo., it was determined to make an effort to have the street improved in order to get better street car service.

An ordinance, providing for the issue of improvement bonds, to pay for the improving and paving with brick, of Washington street, has been passed at Toledo, O. Robinson street will also be improved.

The board of public works of Trenton, N. J., has passed ordinances favoring the paving of North Broad street, Jackson street and Greenwood avenue. North Broad street will be paved with granite blocks.

H. A. Collar, city engineer at Grand Rapids, Mich., writes that the common council of that city, at their last session, ordered gravel roadways, with cobble-stone gutters, as follows: Fremont street, from Walker avenue to Eleventh street; Griggs avenue, from South Division street to Beecham street.

A meeting, under the direction of the committee on public improvements, Newport, R. I., was recently called for the purpose of discussing plans for constructing a boulevard around the city, which would follow the ocean, bay and harbor as far as possible, and, at the same time, provide an easy approach to historical points.

At a recent meeting of the board of city affairs, at Dayton, O., the city engineer was authorized to prepare plans for paving the following streets: King street, from the north line of Third to the south line of Fifth street; Ludlow street, from Third to Washington street; Ludlow street, from the west line of Main to Perry street; Washington street, from Main to Perry; Wilkinson street, from Fifth to railroad tracks. The work will be done in the spring.

CONTRACTS TO BE LET.

Sealed proposals will be received at Cincinnati, O., until December 12, for paving the roadway of Glen Park avenue with brick.

Bids are invited until December 11th, Denver, Col., for the construction of a state wagon road from Dolores, Montezuma county, to Rico, Dolores county.

Bids are invited until December 16th, Norwood, O., for macadamizing the roadbed of Elm avenue. Address J. M. Harper, Ninth and Plum streets, Cincinnati, O.

W. P. Butler, city engineer at Bloomington, Ill., writes that contracts will soon be let for 10,000 lineal feet of stone curbing and for about 24,000 square yards of brick pavement.

CONTRACTS AWARDED.

W. E. Dennison, secretary of the City Improvement Company, has the contract for paving J street, Sacramento, Cal., with bitumen.

Contractor McCabe was awarded the paving contracts in East St. Louis, as follows: Pennsylvania avenue, vitrified brick, $27,189; Sixth street, Telford paving, $8,883.

The contract for furnishing the brick for the completion of the Oliver street pavement in North Tonawanda, N. Y., was awarded the Shale Brick Exchange of Canton, O.

Harvey Linton, city engineer at Altoona, Pa., writes that Messrs. Pennock & Vipond were awarded the contract for paving Twelfth street with asphalt blocks on ten-inch stone foundation at $3.20 per square yard.

Contracts for improving, by grading, the following streets at Youngstown, O., were awarded, as follows: Railroad street, John Kane; Worthington street, M. Horan; Broadway street, Silas Shook.

The public improvement committee at Kansas City, Mo., awarded two paving contracts as follows: Grand avenue, from Independence avenue to Seventh street, vitrified brick, George J. Baer, $4,053.84; Thirteenth street, from Summit to Belleview, vitrified brick, James O'Donnell, $3,026.

H. A. Collar, Grand Rapids, Mich., writes that during the month of November, contracts for gravel roadways with paved gutters were awarded at the following prices: North Prospect street, $2,850; Fernando street, $762.30; Ames street, $824; Charles street, 1,370; Griggs avenue, $2,443.44; Fremont street, $1,633.

The contracts for repaving District No. 574, at Omaha, Neb., were awarded as follows, subject to the selection of material by property owners: Vitrified brick, class B, five-year guarantee, $1.22 per square yard, ten-year guarantee, $1.37 per square yard, to E. D. Van Court & Co.; Sioux Falls granite, class D, $1.90 per square yard, Colorado sandstone, class D, $1.73 per square yard, to J. E. Riley.

SEWERAGE.

The Black snake sewer being constructed at St. Joseph, Mo., is nearly completed.

A summary of the sewer work finished at Racine, Wis., this year shows an expenditure of $115,000.

A sewer is being constructed in East Seventh street, between Mohawk and Utica streets, Oswego, N. Y.

The city of Newark, N. J., expended $25,000 or $30,000 for building small sewers during the past year.

The West End sewer, recently completed at Tacoma, Wash., is nearly three miles in length and cost about $30,000.

A direct drainage into White river has been made at Seymour, Ind., by extending the main sewer. The cost of the extension was $20,000.

The Home street sewer, in New Castle, Pa., is said to be the best in that city. It is provided with the automatic flushing tank syphons.

The sewage disposal works at Chautauqua, N. Y., are pronounced successful. Chemical analyses of the water show it to be free from deleterious properties.

The new sewerage systen at Oberlin, O., has been satisfactorily tested and declared beneficial to the community, both from a sanitary and economical point of view.

Extensive sewer work is being done in Lowell, Mass. The total pay-roll for one week to sewer laborers was $4,687.80, and the work on new sewers promises to exceed that amount.

The Clinton avenue sewer, under course of construction at Trenton, N. J., will cost $7.63 per running foot, which, with a length of about 4,000 feet, will make a total cost of $35,000. Reilly & Co. have the contract.

The section connecting the O. K. creek sewer with the Campbell street sewer at Kansas City, is a fifteen-foot sewer 115 feet long, and was constructed at a cost of $20 per foot, or $2,300 for the entire piece of work.

The outfall sewer at Los Angeles, Cal., has been successfully extended into the sea for a distance of 600 feet. This outfall sewer makes Los Angeles not only one of the best drained cities in the country, but also gives an almost perfect system of sewerage.

Sewer district No. 6 has been accepted at Peoria, Ill. It embraces Jackson street and laterals and the East Bluff system, and is 34,287 feet in length. It cost $57,000. The Carolina street system is 9,475 feet in length, and cost $22,000.

The intercepting sewer being constructed at Easby Point and F street, Washington, D. C., will take the storm water and sewage from an area of 537 acres. Its length will be 10,535 feet, and it will cost $275,368. The Spring road sewer will be a mile in length, and will drain a large section of the western district, and the Fourteenth street sewer will benefit a great portion in East Washington.

H. S. Hoblitzell, city clerk at Missoula, Mont., writes that a sewer system has just been completed in that city which is six miles in length and cost $49,170. The outlet of the system is in the Missoula river, about three-quarters of a mile from the business center of the city. The main sewer is fifteen-inch vitrified pipe, with ten-inch laterals; average depth, thirteen feet; greatest depth, twenty feet. The lateral sewers are supplied with automatic flush tanks, into which is discharged a constant stream of water, the tanks emptying themselves when full, by means of an automatic syphon which flushes the sewer with a ten-inch stream of water, at intervals varying from one to two hours. Riddle and Watts, of Missoula, constructed the system.

L. E. Browne, Richmond, Ind., writes that the final report of the city engineer shows the south-end trunk sewer to be 1,238 feet long; greatest diameter, 5½ feet; deepest cut, 22 feet. The contract price was $11.50 per lineal foot, complete, or $48,000. Williams and Ulrich, of Springfield, O., were the contractors.

The lateral sewers constructed by Muir Bros. & Nicholson, at Marquette, Mich., have been accepted. Estimates made show that in District No. 1, 7,987.1 lineal feet of 8-inch pipe and 1,429.2 of 10-inch pipe, 9 flush-tanks, 12 man-holes, 7 catch-basins and 10 lamp-holes have been put in at a total cost of $6,121.61. In district No. 2, 7,311.3 lineal feet of 8-inch and 840 lineal feet of 10-inch pipe, 9 catch-basins, 8 flush-tanks, 10 man-holes, 11,041 feet of sheathing and 9 lamp-holes were put in at a cost of $5,639.01.

The big North Omaha sewer, under course of construction at Omaha, Neb., will drain about 3,500 acres of land. It extends from the large ravine that empties into Florence lake to the creek near Thirty-second and Sprague streets. The sewer is eight feet and three inches, clear, and is known as a three ring sewer. The walls are fourteen inches in thickness, and 25,000 brick are used daily in their construction. The sewer will be, when completed, nearly two miles in length. Great credit is reflected upon the engineering ability and ingenuity of Mr. Andrew Rosewater, who planned it, for solving a problem that had perplexed others for years.

CONTEMPLATED WORK.

A sewerage system is advised for Owosso, Mich.

Battle Creek, Mich., has issued $10,000 in sewer bonds.

Orange, N. J., contemplates the construction of a sewerage system.

A system of sewerage is contemplated for the north side, Syracuse, N. Y.

The common council at Olean, N. Y., contemplates the construction of outlet sewers.

A system of sewers, to be constructed next spring, is contemplated at Oswego, N. Y.

Plans and specifications for the proposed sewer in White street, Cohoes, N. Y., have been filed.

Jeffersonville, Ind., asks for an appropriation to build a sewer on Meigs avenue to the Ohio river.

The York Board of Trade, York, Pa., has appointed a committee to devise plans for a proposed sewerage system.

An ordinance has been passed at Youngstown, O., providing for the construction of a sewer on East Wood street.

A sewer, extending from St. Clair street, along Gordon Park avenue to the lake, is contemplated at Cleveland, O.

Plans for a new sewerage system for Portsmouth, N. H., have been prepared by Leon E. Scruton, city engineer.

The North Tarrytown board of trustees, Tarrytown, N. Y., has appointed commissioners to construct a system of sewerage.

Surveys have been made for a new sewer, in Rutland, Vt. The sewer will be 3,500 feet long, and will empty into Mussey brook.

Luther Dean, Taunton, Mass., writes that the city council has appropriated $3,650 for a 12-inch pipe sewer on Bryant and Sumner streets.

The citizens of Kittanning, Pa., voted to increase the borough indebtedness to $30,000 for the purpose of constructing a sewerage system.

The construction of a closed sewer is being contemplated at Pontiac, Mich. It is thought that the expense of it will not exceed $28,000.

Surveys and estimates for a sewerage system have been made and submitted to the city council at Grant's Pass, Ore., subject to their approval.

A sanitary sewer will be constructed at Lincoln, Neb., that will extend from the Institute for the Blind to the Missouri river, a distance of 3,000 feet.

At a special meeting held in Newport, N. H., a vote was passed favoring instructions to have the village surveyed and making plans for a sewerage system.

The city of Syracuse, N. Y., contemplates laying 1,250 lineal feet of 18-inch and 1,280 lineal feet of 15-inch tile sewers in Midland avenue. The estimated cost is $4,600.

The sewerage commissioners of Winchester, Mass., have completed plans for a local system of sewers. The estimated cost of establishing the system is $100,000.

Arthur D. Marble, city engineer at Lawrence, Mass., writes that the city has voted to issue $50,000 worth of bonds for the extension of the sewerage system of that city.

The board of public works, Paterson, N. J., recently passed a resolution authorizing the clerk to advertise the board's intention to build sewers in Lynn and Main streets.

The intermittent filtration system is advised for the sewerage system of Plainfield, N. J. The proposed filter-bed consists of a top dressing of soil and some other composition; two feet below is a layer of stone and coarse gravel, and below this are the filter drains. The total cost of the system will be about $25,000.

The city council at Lowell, Mass., has voted to borrow $60,000 for the purpose of constructing sewers this year.

Plans and profiles for all of the sections of the contemplated intercepting sewer at Erie, Pa., have been approved. Erie will have a first-class sewerage system when this is built.

A system of sewerage is contemplated for Charleston, S. C. The Shone system is favored for the reason that the low topography of Charleston is an obstacle in any other system.

Short lines of tile sewers have been ordered at Grand Rapids, Mich., as follows: South College avenue, from Mills to Thomas streets; Williams street, Stocking street and Butterworth avenue.

The finance committee at Lawrence, Mass., voted to recommend to the city council the passage of resolutions for the purpose of raising a temporary loan of $15,000 to carry on sewer work.

An ordinance has been passed at St. Joseph, Mo., providing for the construction of sewers in District No. 4, with laterals and all other appurtenances required to make them efficient and complete.

An ordinance, appropriating $11,000 for the completion of the two sections of the Winshocking sewer, and $6,000 for a main sewer at Barkley street, has been passed by the council of Germantown, Pa.

The board of public works in the city of Indianapolis deem it necessary to construct a local sewer along Pennsylvania street, beginning at the main sewer in South street and extending south 867 lineal feet; a local sewer, beginning at Eleventh street and extending south to Seventh, where it is to divide, one branch running west to Alabama street, thence south to Home avenue, and the other extending east to New Jersey street.

CONTRACTS TO BE LET.

Sealed proposals will be received until December 5, for the construction of a sewerage system in Watertown, Wis.

Bids are invited until December 2 for the construction of sewers on Wood street and Arlington avenue, Youngstown, O.

Bids will be received until December 13, at Cincinnati, Ohio, for constructing a trunk sewer and drains in Badgeley Run.

Charles Ebersold, city clerk at Tell City, Ind., writes that the contract for a brick sewer, 1,000 feet in length, will be awarded next March.

L. E. Browne, city engineer at Richmond, Ind., writes that bids are invited until December 15 for 3,000 lineal feet of vitrified pipe sewer twelve inches in diameter.

CONTRACTS AWARDED.

The contract for constructing a sewer on Bench street, Galena, Ill., was awarded John Heid.

M. J. Condon & Co. secured the contract for constructing a sewer at Knoxville, Tenn., at their bid of $3,783.20.

The city council at Covington, Ky., awarded the contract for the Willow Run sewer to Meyer Bros. of that city.

The contract for building a large sewer, 2,190 feet in length, at Nebraska City, Neb., was awarded T. F. Maher at $1,622.45.

The contract for constructing the trunk sewer at Newburgh, N. Y., was awarded Babcock, Lary & Co., at their bid of $125,-126.80.

The contract for the extension of the main sewer in Nevada, Mo., was awarded George J. Baer, of Kansas City at his bid of $6,470.

The common council at Jamestown, N. Y., awarded the contract for the south side sewer to Wm. Franklin, of Buffalo, N. Y., at his bid of $58,188.

The contract for laying the Wentworth avenue sewer, Chicago, was awarded Wilson & Jackson, as follows: Section A, $282,245; Section C, $111,385.

The contract for building a sewer in Park avenue, Racine, Wis., was awarded Hausen & Sachce. The sewer will be of Racine cement pipe and will cost $2,555.93.

The contract for building sewers in Lancaster, Pa., was awarded Otto Bros., as follows: Chestnut street sewer, 80 cents per foot; North Queen street sewer, $600.

The successful bidders for the main sewers to be constructed at Philadelphia, Pa., were as follows: Daniel McMahon, A. H. Achuff, Geo. W. Ruch, C. P. Grim & Co., Chas. J. Kennedy, P. P. Beris. The cost of the work aggregates $250,000.

Eugene Kirk, Youngstown, O., writes that contracts for the construction of sewers in that city have been awarded as follows: Hine street, F. E. Gribben; South Champion street, James Cassaday; Duquesne street, F. E. Gribben.

Contracts for constructing sewers at Grand Rapids, Mich., were awarded as follows: South College avenue, $203; Butterworth avenue, $389.67; Stocking street, $497; Williams street, $594; Earl and Marion streets, $250.

Fred H. Pickles, city engineer at Winona, Minn., writes that the Winona Construction Company was awarded the contract for laying sewers as follows: 1,110 lineal feet of 15-inch pipe sewer, 40 cents; 735 lineal feet of 12-inch pipe sewer, 30 cents; 280 lineal feet of 8-inch pipe sewer, 20 cents; 14 catch-basins, $12; 5 man-holes, $18.

W. P. Butler, city engineer at Bloomington, Ill., writes that contracts have been awarded for the construction of vitrified pipe sewers as follows: Three hundred and ninety feet of 12-inch and 1,003 feet of 12-inch sewers, R. R. McGregor & Co.; 1,442 feet of 15-inch, 500 feet of 18-inch and 1,900 feet of 15-inch sewer, Patrick McDonald; 554 feet of 12-inch and 1,190 feet of 15 inch sewer, Robert Loudon.

Contracts for sewers have been awarded in Syracuse, N. Y., as follows: 550 lineal feet 15-inch tile sewer in Tallman street, to James Swift for $480.50; 250 lineal feet 18-inch tile sewer in E. Water street, to Martin & Sullivan, for $773.50; 1,100 lineal feet 28-inchx42-inch brick, 800 lineal feet 22-inch x33-inch brick, 620 lineal feet 18-inch tile and 640 lineal feet 15-inch tile sewers in North Salina street, to Thomas Marnell for $22,997; 320 lineal feet 20-inchx30-inch brick, 950 lineal feet 18-inch tile and 1,310 lineal feet 15-inch tile sewer in North Salina street, to J. W. Bustin for $8,872.

WATER-WORKS.

The water-works system at Huntingburgh, Ind., is nearly completed.

The system of water-works at Sistersville, W. Va, was completed last month.

The water-works system at Deadwood, S. D., is said to be one of the finest in the country.

The new water-works system recently constructed at Buckingham, Que., will cost about $50,000.

The stand-pipe which was completed recently at Fairport, N. Y., holds 300,000 gallons of water.

The new reservoir at Frederick, Md., is nearly completed. The total cost of it will be about $15,000.

The village trustees at Mechanicsville, N. Y., have accepted the new water-works system constructed by Gray and Temple, of Lansingburgh, N. Y.

A map of the city water-works at Bonham, Tex., shows a dam 1,200 feet long, a reservoir covering 68½ acres of ground, with a capacity for 309,538,806 gallons of water.

The water-works system in Lake City, Minn., are completed. The cost of the entire plant was $25,000. The power-house is 30 x 50 feet, with a pump of 1,000,000 gallons capacity.

The work of constructing a new system of water-works in South Milwaukee has begun. Two Worthington pumps, with a capacity of 750,000 gallons per day, have been purchased. The cost of the system will not exceed the sum secured by the sale of the bonds, $36,000.

The system of water-works, recently completed at Belmont, N. H., has been accepted.

The object of the Baden station at St. Louis is to supply the suburban portion of the city with water. When completed it will consist of six high service engines, with a daily pumping capacity of 10,000,000 gallons. The Baden station will not be ready for service for three years. St. Louis claims that before 1897 the city will have the finest system of water-works in the United States. The water supply will then be taken from a point in the river, 10 miles above the Lowell factories. Before being pumped into the city it will be drawn off into huge reservoirs and filtered and settled.

CONTEMPLATED WORK.

Rialto, Cal., will have a system of water-works.

A system of water-works is contemplated at Pen Argyl, Pa.

A system of water-works has been proposed for Cassville, Wis.

A system of water-works will be constructed at Fowler, Ind.

A complete water-works system will be put in at Alexandria, Ind

A water-works plant is contemplated for Ransom, Ill., next spring.

A system of water-works will be constructed at Athens, Tenn.

A system of water-works will be constructed at Henrietta, Tex.

A system of water-works is being contemplated at Unionville, Mo.

Griffin, Ga., will vote, December 6, to issue $16,000 worth of water and light bonds.

A system of water-works, at a cost of $800,000, is contemplated at Duluth, Minn.

A system of water-works, including a water tower, is contemplated at Shellman, Ga.

The citizens of Glassborough, N. J., contemplate putting in a water-works plant at once.

A system of water-works will be constructed at Park Rapids, Minn., at a cost of $8,000.

Ottawa, Ill., has voted to issue $50,000 in bonds for the construction of a system of water-works.

Plans and specifications have been prepared for a system of water-works at Southampton, L. I.

Surveys have been made for the proposed site of the water-works plant contemplated at Haverhill, N. H.

A system of water-works is contemplated at Dodgeville, Wis. Estimates made place the cost of it at $13,000.

The question of securing a system of water-works for New Harmony, Ind., is receiving careful consideration.

The citizens of Bangor, Pa., voted to increase the public debt for the purpose of erecting a water-works plant.

A special election held at Youngstown, O., resulted in favor of those wanting an extension of the water-works system.

Jackson, Mich., has voted to raise $20,000 for the purpose of extending and otherwise improving the water-works system.

Plans and estimates of the cost of water-works for the city of Dallas, Ore., have been submitted by Messrs. Riley & Morrison.

A petition is being circulated which will be presented to the city council at Lakeside, Ind., asking for a system of water-works.

Winchester, Va., has accepted plans for a system of water-works. Mr. Alexander Potter, of New York City, prepared the plans.

The citizens of Port Jervis, N. Y., passed resolutions requesting the board of trustees to take the necessary steps for the construction of a water-works system.

Bonds for water-works have been sold at Orrville, O. The work of construction, under the superintendency of Alexander Potter, of New York, will begin in March.

The citizens of Norwalk, O., will vote in December on appropriating $4,000 to the repairing of the water-works stations, and replacing ten-inch mains with sixteen-inch pipe.

An estimate of the necessary improvements required for the city water-works, at Cincinnati, O., are as follows: Main pipe extension, $100,000; contract Eden Park engines, $15,000; contract Eden Park four-million gallon engine, $10,500; contract engines Nos. 7 and 8, $18,700; Price Hill tanks, $27,400; Eden Park boilers for pumping station, $8,400; Price Hill tank house and foundations, $40,000; Cumminsville reservoir lot, $9,000; Cumminsville reservoir, $10,000; Fairmount water supply, $25,000; completion of Eden Park distributing mains and contracts for pump, well, etc., $50,000; completion of Eden Park station, steam and water connections, flows, etc., $20,000; rebuilding No. 5 engine and erecting Nos. 7 and 8 engines, $12,000; completion of 36-inch force-main for pumping station at Eden Park reservoir, $30,000; outstanding claims and contracts, $100,000; operating expenses, $564,000. Total for 1894, $1,040,000.

The citizens of Warrensburgh, Mo., have voted in favor of a system of water-works.

Water-works systems are contemplated at the following places: Bowie, Tex.; Llano, Tex.; Oregon, Mo.; North Redwood, Minn.; Marshall, Mich.; Lunenburg, Mass.; Elkins, W. Va.

A resolution, unanimously favoring the question of bonding the city for a sum not to exceed $7,000 for the purpose of building a system of water-works, was recently passed by the city council at Griswold, Ia.

CONTRACTS TO BE LET.

Bids are invited, until January 2, 1894, for erecting and constructing a system of water-works in the city of Berlin, Wis.

Sealed proposals will be received until December 4, for labor and material required in laying water service pipes in Wilcox avenue, from West Fortieth street to West Forty-sixth street, Chicago Ill.

Plans and specifications for a system of water-works at Centralia, Ill., have been prepared by Hiram Phillips, of St. Louis, Mo. Bids will be received until December 26, for the work. The estimated cost is $60,000.

CONTRACTS AWARDED.

The contract for erecting a water-works plant at Paulsboro, N. J., was awarded Paul Bros.

The contract for constructing the water-works system at Howell, Mich., was awarded Mr. Max Walker, for $27,908.

Inman Bros., of New York, secured the contract for constructing the new water-works system at South Amboy, N. J.

The city of Marengo, Ill., has contracted for a water-works system and electric light plant combined, at a total cost of $33,726.

The borough council at Westchester, Pa., awarded to George Frame the contract for building the new reservoir, at his bid of $1,259.18.

The contract for constructing the new system of water-works at Atlanta, Ga., was awarded Harmon P. Malone, of Hollidaysburg, Pa. The line will be seventeen miles long.

BRIDGES.

Richmond, Tex., will have a new steel bridge.

Pottawatomie county, Kan., spent $10,000 for bridges this year.

The bridge across the Russian river at Healdsburgh, Cal., is open for travel.

The new wagon bridge over the Wabash at Americus, Ind., is completed, and open for travel.

A bridge is to be constructed over the Colorado river at Wharton, Tex., at a cost of $35,000.

Bids are invited until December 4 for building two wooden bridges at Yankton, South Dakota.

A combination bridge will be constructed over the St. Louis river, between Rice's and Connor's Points, Minn.

The iron bridge over the Fox river at Depere, Wis., is completed. It is 1,500 feet long and cost $40,000.

The contract for building a bridge over the Santiago Creek, between Orange and McPherson, Col., was awarded for $1,750.

A new steel bridge will replace the wooden bridge across the Mississippi river at St. Cloud, Minn. The estimated cost is $45,000.

A scheme is being planned, which, if successful, will make the new steel bridge across the Missouri river, at Kansas City, free to wagons.

The board of public works at Milwaukee, Wis., contemplates the construction of a new bridge across the Kinnickinnick river at Potter avenue.

The city council at Council Bluffs, Iowa, will advertise for bids for the construction of an iron bridge over Indian creek, on North seventh street.

C. F. Loweth, of St. Paul, Minn., was awarded the contract for preparing plans for a wagon bridge across the Mississippi river at Red Wing, Minn.

The new Court street bridge, at Flint, Michigan, which was constructed by the Wrought Iron Bridge Co., of Canton, Ohio, was accepted November 6, by the bridge committee.

Bids will be received at Indianapolis, Ind., until December 15, for the construction of a bridge railing for the north end of the bridge across Pogue's Run, at Washington street.

A sum of $40,000 has been secured for the purpose of constructing a wagon bridge over the Missouri river at Jefferson City, Mo. Twenty-five thousand dollars more is needed for the bridge.

The contract for an iron bridge over the Miami river at New Richland, O., was awarded the Columbus Bridge Company for $1,375. This includes abutments and erection of the superstructure.

The construction of the iron bridge at Flandreau, S. D., is completed. The bridge consists of one span, 138 feet in the extreme, with a clear width of 18 feet, and a sidewalk 5 feet in the clear. The piers are 3 feet in diameter and 18½ feet from the water to the joists. The bridge cost $4,000.

Two iron bridges will be constructed across the White river in Martin county, Ind., by the Lafayette Bridge Company, Each structure will be 380 feet in length, with two spans, and will cost $40,000.

A new bridge will be constructed across Union avenue, Tacoma, Wash. It will be 620,000 feet long, 60 feet wide and 155 feet high at the greatest depth, and will require 500,000 feet of lumber. The cost will be $5,500.

The contract for a bridge across Cedar river, Renton, Wash., was awarded to Brown Bros., of South Seattle. They will put in a combination steel and wood span bridge with pile piers for $1,025, and approaches at $1.55 per lineal foot.

The longest wagon bridge in the world was accepted October 29, at Galveston, Texas. The bridge is steel and spans the bay, connecting the island and main land. It is more than two miles in length, and cost $191,986.

The new iron bridge completed at Albany, Ind., is one of the best bridges in Delaware county. The span is fifty feet, with thirty feet of roadway and six-foot sidewalks on each side, with an iron railing or protection.

The commissioners of White and Carroll counties, Ind., awarded the contract for an iron bridge over Big Creek. The La-Fayette Bridge Co. was awarded the superstructure at $750, and L. T. Kent the masonry at $2.20 per cubic yard.

The new iron bridge over the Potomac river, at Brunswick, Md., recently completed, consists of ten spans, each one being a few inches over 171 feet, making the length of the bridge 1,710 feet. The width of the bridge is 16 feet. Total cost, $62,000.

The city council of Kaukanua, Wis., awarded the contract for the new iron bridge across the Fox river to the Milwaukee Bridge and Iron Company for $29,660. This sum includes the stone work, which has been sub-let to Lindauer and Smith, for $11,450.

Drawings have been made for an overhead bridge, at Youngstown, Ohio. The bridge will extend from West Wood street to West Federal street and from Federal street to Mahoning avenue. The drawings show the bridge divided into two parts, making two bridges. Access to the bridge reaching from Federal street to Wood street will be made by means of an inclined fill, and, from Federal street to Mahoning avenue, will begin on a level with Federal street, and the approach to the other end will begin on Mahoning avenue, 150 feet from the Mahoning avenue end of Spring Common bridge.

A resolution has been approved by the council finance committee at Milwaukee, Wis., appropriating $45,000 for a bridge across the Milwaukee river, from the foot of Washington street to Jones Island.

J. J. Weaver, city engineer at Ludlow, Ky., writes that a bridge, that will be known as the Covington, West Covington and Ludlow highway bridge, will be constructed. It will have five 30-foot girder spans, 26.6-foot roadway, and one eight-foot sidewalk.

Bids will be received until December 4, at Kenton, Ohio, for a wrought-iron bridge, to be built across the Scioto river, on Main street. The bridge is to be 103 feet long, pin centers; a 24-foot roadway, and a 6-foot sidewalk on each side, and must have a capacity of 100 pounds per square foot.

STREET LIGHTING.

Fred H. Pickles, city engineer at Winona, Minn., writes that the city will, in March, make a new contract for lighting the city, or put in a plant of its own.

L. E. Browne, Richmond, Ind., writes that proposals for a system and plant for electric street lighting will be received until December 18. Specifications may be had from the city clerk.

The city of Missoula, Mont., has contracted with the Missoula General Electric Light Company for thirty or more arc lights of 1200 candle-power each, at $16.50 per light per month, for seven years.

Sealed proposals will be received until December 12, for lighting the public streets of the township of Kearney, Hudson county, N. J., with electric arc lights, for a term of three or five years from April 1, 1894.

The Richmond Heat, Light and Power Company are building an addition to their gas plant for the purpose of installing an electric plant for street and commercial lighting. Information may be obtained from Wm. Roney, secretary.

STREET RAILWAYS.

Baltimore, Md., has twenty-one rapid transit lines in operation.

Bids are invited until February 1, 1894, by the minister of public works, Cairo, Egypt, for establishing a system of street railways in Cairo and its environs.

The city of Glasgow has ordered 200 street cars, at a cost of $150,000. The order, which has been divided among English builders, is one of the largest orders that has been let in Europe for several years.

An electric line is projected by capitalists of Logansport, Elwood and Franklin, Ind. Their purpose is to build an electric street railway line from Elwood to Franklin.

An electric street railway for Tokio, Japan, is being planned by Ohio capitalists, whose intention, is to run a line from Tokio to Yokohama, a distance of 30 miles, and build a net-work of lines in both cities.

An ordinance has been adopted at Detroit, Mich., granting to the Detroit Suburban Railway Company, a franchise to construct and operate a double track street railway from the Woodward avenue railroad crossing to the northern limits of the city, a distance of about two miles.

The electric railway committee of the city council, Montreal, Canada, favors granting the Belt Line Railway Company permission to construct an elevated road on Delorimier avenue, Ontario, St. Catharine, Craig and St. James streets. The work will begin before June 1, 1894.

PUBLIC PARKS.

Plans are being devised for a city park, at National City, Cal.

Land has been purchased at Clinton, Ia., for the purpose of making a city park.

The park commissioners at Bridgeport, Conn., will take steps to have Washington Park properly drained.

The citizens of Hammond, Ind., have purchased 50 acres of land, which will be laid out and improved for park purposes.

The citizens of Newport, Ky., are anxious for the Government to donate to the city the Newport Barracks for park purposes.

The city of Peoria, Ill., has been presented with 100 acres of ground by Mrs. Lydia Bradley, on the condition that the city maintain the grounds as a park.

MUNICIPAL BONDS.

Bids will be received until December 18, Columbus, Ohio, for the purchase of $35,000 of six per cent. viaduct bonds.

W. E. Wichgar will receive bids until December 2, Norwood, Ohio, for the purchase of $3,576.92 of six per cent. street improvement bonds.

Bids are invited until December 13, by the board of trustees of the sanitary district, Chicago, Ill., for the purchase of $3,000,000 of five per cent. bonds.

Sealed bids will be received until December 5, Fairmont, Minn., for the purchase of $20,000 electric light and water-works bonds. Bonds to bear interest at the rate of six per cent. per annum, payable semi-annually.

SEALED PROPOSALS.

PURCHASE OF BONDS.

Sealed bids will be received at the office of the City Auditor, Cleveland O., until 12 o'clock, M., December 6, for the purchase of $130,000 five per cent. City of Cleveland canal coupon bonds, maturing October 1, 1903. These bonds draw interest from October 1, 1893, and will be issued by the city of Cleveland, under due authority of law and ordinance, both principal and interest being payable at the American Exchange National Bank, New York City, interest payable semi-annually. A certified check drawn on a national bank for five per cent. of the amount of bonds bid for and payable to the order of the treasurer of the city of Cleveland must accompany each bid. No bid will be entertained unless made on a blank form, which can be obtained on application to the City Auditor. No bids for less than par and accrued interest to the day of delivery will be accepted. Bonds to be delivered to the buyer at Cleveland. All bonds are $1,000 denomination.

W. A. MADISON, City Auditor.
W. W. ARMSTRONG, City Treasurer.

NOTICE TO BRIDGE CONTRACTORS.

Notice is hereby given that the Board of Commissioners of Marion county, state of Indiana, will receive sealed proposals at the county auditor's office, in Indianapolis, Indiana, until December 1, 1893, at 2 o'clock P. M., for the substructure and superstructure of a bridge over White river, near Indianapolis, on the Grandview avenue free gravel road. Said road being an extension of the Osterman free gravel road. Plans and specifications for the substructure and superstructure of said bridge to be on file in the auditor's office of said county, and open to the inspection of bidders on and after Thursday, November 23, 1893.

Each bidder must file with his bid a good and sufficient bond signed by at least two good resident free-holder sureties, as required by sections 4245 and 4246 of the Revised Statutes of the state of Indiana, and no bid will be received or entertained unless accompanied by said bond, and all bonds must be in an amount equal at least to the amount of the bid which it accompanies. Blank bonds can be obtained at the auditor's office of said county. The board reserves the right to reject any and all bids.

By order of the Board of Commissioners of Marion county, state of Indiana.

MICHAEL H. FARRELL,
FURMAN STOUT,
JOSEPH L. HUNTER,
Commissioners.

TRUNK SEWER.

Sealed proposals will be received at the office of the Board of Administration, Cincinnati, Ohio, until 12 o'clock noon of Wednesday, December 13, 1893, for improving rights of way in Badgeley Run, Chase and Virginia avenues, and Kirby road, from a point 200 feet south of Chase avenue to a point in Badgeley Run 400 feet north of intersection of Kirby road and Virginia avenue, by constructing a trunk sewer and drains, with the necessary appurtenances thereto, in accordance with plans on file in the office of the Chief Engineer of the Board of Administration, and according to specifications on file in the office of the Board of Administration. The same to be paid for as provided for in the resolution and ordinance for said improvement.

The board reserves the right of rejecting any or all bids.

Bidders must indorse their names and address upon the outside of the envelopes containing their bids.

Each bid to be accompanied by two disinterested sureties.

Bidders to use the printed forms, as none other will be received.

By direction of the board.

AUG. HERRMANN, President.
A. P. BUTTERFIELD, Clerk.

ROAD IMPROVEMENT.

STATE ENGINEER'S OFFICE,
DENVER, COLO., Nov. 6, 1893.

Sealed proposals for the construction of a state wagon road from Dolores, Montezuma county to Rico, Dolores county, Colorado, will be received at the office of the State Engineer, 814 Equitable block, Denver, Colo., until noon, December 11, A. D. 1893, under the provisions of House Bill No. 377, entitled "An act to aid the counties of Montezuma and Dolores, Colorado, in constructing a wagon road from Dolores, Montezuma county, Colorado, to Rico, Dolores county, Colorado, and making an appropriation therefor." Approved April 14, 1891.

The plat and specifications for said wagon road can be seen at the office of the State Engineer and at the office of the County Clerk of Montezuma county, in the town of Cortez, Colorado.

Bidders are requested to make a personal examination of the line of said wagon road before submitting their bids for the construction of the same.

Each bid must be accompanied with a bond in the penal sum of one thousand (1,000) dollars, signed by the bidder, and his sureties justified and approved by the county clerk of the county in which the bidder resides, as a guarantee that the successful bidder will give a good and sufficient bond in the sum of twenty thousand (20,000) dollars, and will enter into a contract to complete said wagon road on or before the 15th day of August A. D., 1894.

Bidders are required to name a lump sum for which they will finish the wagon road complete in accordance with the requirements of the plans and specifications.

The Board of Construction reserves the right to reject any or all bids.

C. B. CRAMER,
State Engineer.

BONDS.

Sealed bids will be received at the office of the Village Recorder of Fairmont, Minn., up to 12 o'clock, noon, December 5, 1893, in first bonds to the amount of $20,000, duly voted by said village for electric lights and water-works; $10,000 to be made payable in fifteen years, and $10,000 payable in twenty years from date of issue. Said bonds to bear interest at the rate of six per cent. per annum, payable semi-annually. For full particulars, address C. N. PETERSON, Village Recorder.

NOTICE OF CONSTRUCTION OF SEWERS.

DEPARTMENT OF PUBLIC WORKS,
COMMISSIONER'S OFFICE, CITY HALL,
PROVIDENCE, R. I., Nov. 7, 1893.

Sealed proposals will be received at this office until 11 o'clock, A. M., Saturday, December 2, 1893, for constructing sewers for the improved sewerage system as follows:

In section 10, Allen's avenue division: About 2,137 feet 102-inch circular brick sewer; average cut 26 feet.

In section 11, Allen's avenue division: About 2,248 feet 102-inch circular brick sewer; average cut 23 feet.

In section 12, Allen's avenue division: About 2,322 feet 102-inch circular brick sewer; average cut 22 feet.

In section 13, Woonasquatucket river division: About 1,458 feet 75-inch circular brick sewer; average cut 22 feet.

In section 14, Woonasquatucket river division: About 1,665 feet 74-inch circular brick sewer; average cut 20 feet.

All proposals must be made upon the blank forms which will be furnished for that purpose, and each sewer must be bid for separately.

Plans may be seen and specifications and forms of contract can be obtained at the office of the City Engineer in Providence, R. I.

Each bidder is requested to give reference as to his business standing, and to state generally what experience he has had in such work as here proposed

No bid will be considered unless accompanied by a certified check for the sum of one thousand dollars.

A satisfactory bond for a sum equal to about one-fifth of the estimated amount of the contract, conditioned upon the faithful performance of the contract will be required of the succesful bidder.

The right to reject any or all proposals is reserved

ROBERT E. SMITH,
Commissioner of Public Works

SOME OF MANY COMMENTS.

INTERESTS THE BRICK CONTRACTORS.

COLUMBUS, O., Jan. 12, 1893.

Editor Paving and Municipal Engineering:

DEAR SIR—The January number of your Journal received. Am greatly pleased with its new form and dress, consider it the best magazine published on the topics it embodies, being full of timely hints and articles of value bearing on my business, which is brick street paving. But this is not the only part that interests me, for I read its entire contents and profit thereby. Yours truly, F. W. CERNY.

A WORK OF ART.

RED WING, MINN., Jan. 13, 1893.

Your magazine certainly is a work of art and does great credit to your institution and to the cause it advocates.

Yours truly,
RED WING SEWER PIPE CO.,
C. E. SHELDON, *Sec'y.*

WHERE IT HAS HELPED.

WINONA, MINN., Jan. 12, 1893.

We esteem your periodical highly and it has been of much value to us in reaching a conclusion upon paving, which we are about to enter upon here.

Yours truly, C. A. MOREY,
Chairman Com.

A MODEL NUMBER.

OMAHA, NEB., Jan. 12, 1893.

Please allow me to congratulate you on the January number of "PAVING AND MUNICIPAL ENGINEERING." It's a model number and I trust that the same excellence will be maintained.

Very truly yours,
JOHN GRANT, *Pres.*
Grant Asphalt Paving and Slagolithic Co.

MAY IT LIVE LONG AND PROSPER.

PULLMAN, ILL., Jan. 12, 1893.

I am much pleased with "PAVING AND MUNICIPAL ENGINEERING," in its new dress. May it live long and prosper. WILLIAM LEE.

INTERESTING TO MUNICIPAL ENGINEERS.

BAYFIELD, WIS., Jan. 13, 1893.

The new form is truly a great improvement over the other form. All who are engaged in municipal engineering will hail with delight the contributions found therein. D. F. GLOVER.

THE GENERAL VERDICT.

BINGHAMTON, N. Y., Jan. 12, 1893.

I am much pleased with "PAVING AND MUNICIPAL ENGINEERING." It is very interesting and instructive. Very truly yours,
S. E. MONROE, *City Engineer.*

INTERESTED IN PAVING BRICK.

MT. VERNON, O., Jan. 14, 1893.

I am well pleased with its appearance and as brick paving has come to stay, I eagerly devour all that is calculated to throw light on that subject.

Very respectfully, A. CASSIL, *C. C. E.*

APPROVED IN ALL RESPECTS.

PHILADELPHIA, PA., Jan. 13, 1893.

The January number of your Journal in its new form meets with our approval in every respect. It is much more attractive and convenient than the old form and we think you will undoubtedly find it a step in the right direction. Wishing you success. Yours truly, CHAMBERS BROTHERS CO.,
J. H. CHAMBERS, *Gen'l Mgr.*

WILL CONTINUE TO READ IT.

MANKATO, MINN., Jan. 13, 1893.

I have received your Journal for some two years and in its new form shall continue to read it.

Truly yours, M. B. HAYNES, *City Engineer.*

THINKS IT A GREAT IMPROVEMENT.

MINNEAPOLIS, MINN., Jan. 14, 1893.

Your handsome monthly in the new form is received. We think it a great improvement on the old style, and the editorial and contributed articles are interesting and valuable for preservation, and in convenient form for binding. Wishing you a large success, we remain, yours truly,
PARKHURST PAVING CO.

BRIEF, BUT GRATIFYING.

TROY, N. Y., Jan. 12, 1893.

We congratulate you.
OSTRANDER FIRE BRICK CO.

LIKE ITS NEW STYLE.

BOSTON, MASS., Jan. 13, 1893.

We are pleased with its "new garments" and typographical arrangement.

POPE MFG. CO.

WILL BE OF MUCH USE.

MOBILE, ALA., Jan. 12, 1893.

It strikes us that you made a great improvement in your magazine and we believe it will be of much use to all parties interested in municipal work.

Yours truly,
IMPROVED WOOD PAVEMENT CO.,
By A. C. DANNER, *President.*

EVEN THE ADVERTISEMENTS ARE IMPROVED.

PHILADELPHIA, PA., Jan. 16, 1893.

To say there is a decided improvement in your magazine is putting it very mildly indeed. The specimen cover published in your December issue was evidence to me of a great improvement in form and taste; to me it is very taking. I was not prepared, however, for the improvements in the inside arrangements. Why, everything is improved—even the advertisements. To tell you all I think about it would seem fulsome. I really am much pleased with it and as to suggesting improvements, why, you have not left me an inch of room.

Yours truly, WILLIAM WAPLINGTON.

CALLS THE ATTENTION OF COUNCIL TO IT.

BOONE, IOWA, Jan. 16, 1893.

I think it just the kind of periodical needed by parties interested in that kind of work, and shall call the attention of the City Council to the matter at its next meeting. Respectfully,
W. W. HIXON, *City Clerk.*

A GREAT IMPROVEMENT.

NEW YORK, Jan. 17, 1893.

New form is great improvement. By judicious selection of best information on construction and maintenance of different kinds of road pavements—Europe is a very important source from which to draw—your paper could become the recognized authority on that subject in America.

Yours truly, RUDOLPH HERING,
No. 277 Pearl St.

MORE CONVENIENT FOR REFERENCE.

MICHIGAN CITY, IND., Jan. 11, 1893.

I like the new form much better than the old as it is more convenient for binding and keeping for future reference. Yours, etc., H. M. MILES,
119 E. 9th St.

ONE OF THE BEST.

FOSTORIA, OHIO, Jan. 17, 1893.

The magazine needs no suggestions to improve it as it already is one of the best published and the form is the best. Yours very respectfully,
FRANK GEBERT.

LIKES THE BIOGRAPHIES.

EVERETT, MASS., Jan. 15, 1893.

I am very much pleased with "PAVING AND MUNICIPAL ENGINEERING" in its new form, especially the short biographies of contributors.

Yours, etc., GEORGE L. MIRICK.

143 and 145 George St.

CINCINNATI, O.,

U. S. A.

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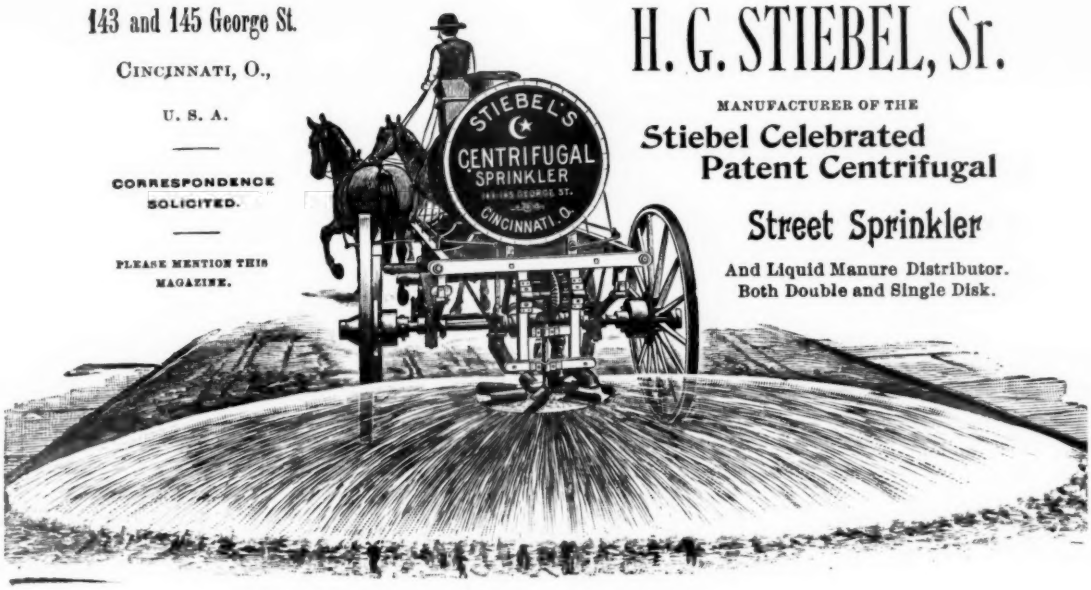

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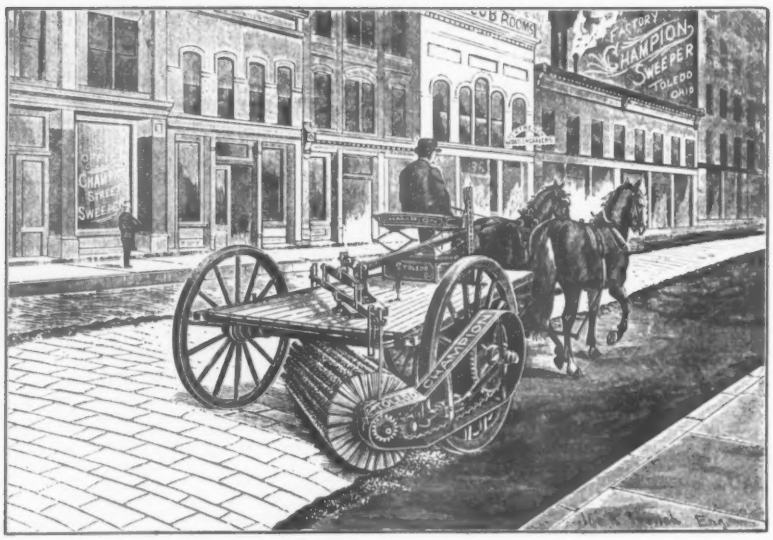

To the Hon. the Board of Public Works of the City of Saginaw:

GENTLEMEN—The question of purchasing street sweeping machinery for the eastern highway department, which was brought to your attention some time ago and referred to us to examine and report to you, has been under consideration by us for some time, and we now submit the following for your consideration:

We have examined the cuts and recommendations of six different machines and the testimonials of each from the city officers and municipal authorities of the cities where they are in use, and such other information as could be procured by correspondents, and we are of the opinion that the "Champion" is the best machine, everything considered, for our use.

The merits of the machine briefly are these: It will sweep from two to four inches of mud and street accumulations into windrows with one team of horses at one sweeping. It will sweep equally well on all kinds of pavements in all conditions. The use of steel wire in place of rattan or bass in the broom enables it to sweep equally clean in mud or dust and at a saving of nine tenths of the cost of keeping the brooms in repair.

Yours respectfully,

R. W. ROBERTS, City Engineer.

ALLISON J. MCINTYRE, Sup. of Streets.

At the meeting of the Board of Public Works, held March 18, 1893, the City Engineer was instructed to order "Champion" sweeping machine according to the recommendations hereto annexed.

Very respectfully, ALFRED DAVIS,
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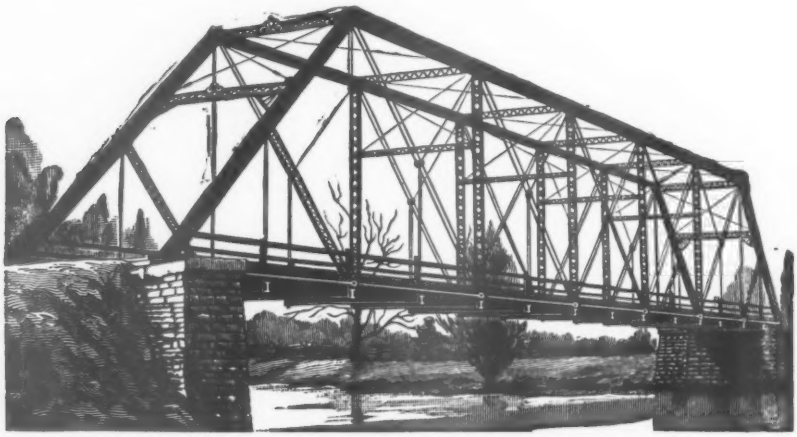

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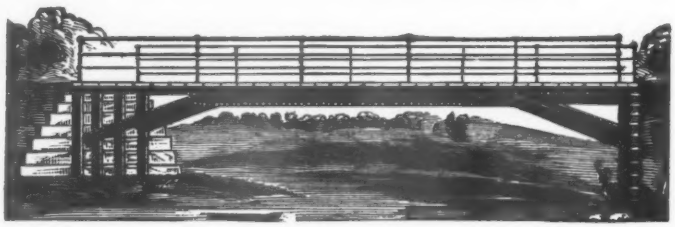

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CONTENTS.

Vol. V. DECEMBER, 1893. No. 6.

Artistic Effect in Street Improvement ..... *Frank Knight.* 247
The Origin of American Asphaltic Pavements ..... *E. J. De Smedt.* 251
How France Got Good Roads ..... *Arthur Lagron.* 253
Sewerage Discussed for the Laity ..... *John W. Hill.* 257
Tests of an Electric Street Railway 265

Current Information.

Street Paving in the National Capital 266
Cheap Street Paving in Saginaw 267
Asphalt and Roadmaking ..... *J. S.* 268
Minneapolis Aldermen Now Favor Brick 269
Work for the Unemployed 270
Bridges in the District of Columbia 270
Street Railway Tracks on PavedStreets 271
Underground Street Railway Wires 271
Baltimore's Good Sewers 271
Sandstone for Paving 272
What Grand Rapids Has Done 272
Association of Engineers of Virginia 272
Better Sidewalks on Washington 273
Permits for Street Openings 274
Slag as a Substitute for Stone 274
Baltimore's Street Paving Commission 274
The Los Angeles Water-works 274
Personals 274

Machinery and Trade.

Some Recent Patents ..... *V. H. Lockwood.* 275
Economical Excavation in Sewer Building (Illustrated) 276
Consolidation of Paving Brick Companies 279
Consolidation of Sewer Pipe Companies 279

Improvement and Contracting News.

Paving 280
Sewerage 282
Water-works 285
Bridges 286
Street Lighting 288
Public Parks 288
Street Railways 288
Municipal Bonds 288

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ALPHABETICAL INDEX TO ADVERTISERS.

Adams, John N 39
Addyston Pipe and Steel Co 40
Anderson, Latham 10
Andorra Nurseries 3
Arnold, D. J. C 39
Aschman, F. T 10

Baltimore & Ohio Railway 42
Barber Asphalt Paving Co 8
Barrett Mfg. Co., S. E 27
Bartlett, C. O 30
Bauer, H. C 38
"Big Four" Railway 35
Bollenbacher, Geo. N 27

California Petroleum and Asphalt Co 31
Carson Trench Machine Co 38
Cary & Moore 10
Central Machine Works 30
Chambers Bros. Co 46
Champion Street-Sweeper Co 26
Chase, C. P 27
Chicago Union Lime Works Co 11
C., H. & D. Railway 35
Columbia Paving Co 13

Decatur Leader Mfg. Co 33
Otto D. Droop 12
Dunham, F. A 10

Enterprise Manufacturing Co 39
Erie Machine Shops 41
Eudaly, W. A 37

Fate-Gunsaullus Co., The 31
Fletcher & Thomas 43
Freese & Co., E. M 34
Frey-Sheckler Co 2
Fuller & Co 11

Gates Iron Works 38

Hammatt, E. A. W 10
Harrisburg Foundry and Machine Works 41
Hayes, W. J. & Sons, Bankers 11
Hoge & White 10
Houghton, J. H 27

Indiana Bridge Co 4

Kimball, Geo. A 10
Knight, H. W 23

Layman, E. F 10
Landreth, Olin H 10
Leffmann Henry, M. D 11
Lemon, George E 35
Lockwood, V. H 35

Monon Route 42
Thos. F. Moore 30
Municipal Engineering Co 24, 42

New York & Bermudez Co 8
New York Mastic Works 12
Nicoli, Chas. A 38

Ohio Paving Co 14

Park & Sons Co., J. D 28
Penfield & Son, J. W 44
Phillips, Hiram 10
Pike, E. M 35
Pittsburgh Testing Laboratory 27
Pope, R. C 40
Porter Co., The John 13
Potter, Alexander 10
Purington Paving Brick Co 14

Rae, Frank B 10
Raymond, C. W. & Co 43
Rosewater, Andrew 10

Schillinger Bros 12
Sealed Proposals 23
Sercombe, Osman & Warren 36
Shale Brick Exchange 14
Sharer Dryer & Construction Co., The 16, 17
Shearer, S. H 10
Sicilian Asphalt Paving Co 12
Smith, Porter & Co 13
South Bend Cement Co 30
Standard Asphalt Co 12
Stiebel, H. G., Sr 25

Taplin, Rice & Co 32
Thiele, E 27

United States Brick Press Co 29

Wabash Clay Co 13
Warren-Scharf Asphalt Paving Co 18
Wellington Machine Co 45
Western Paving and Supply Co 15
White, Wm. J 10
Wickenden & Clark 10
Wrought Iron Bridge Co, ... 6

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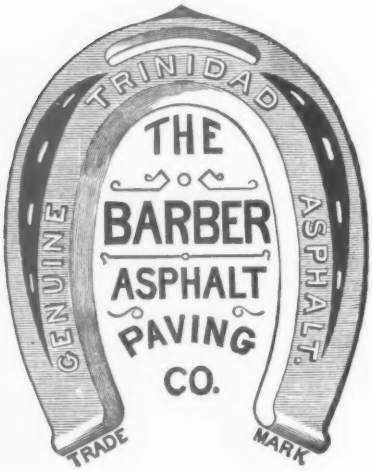

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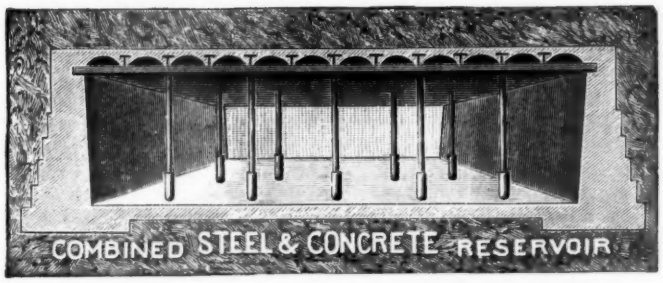

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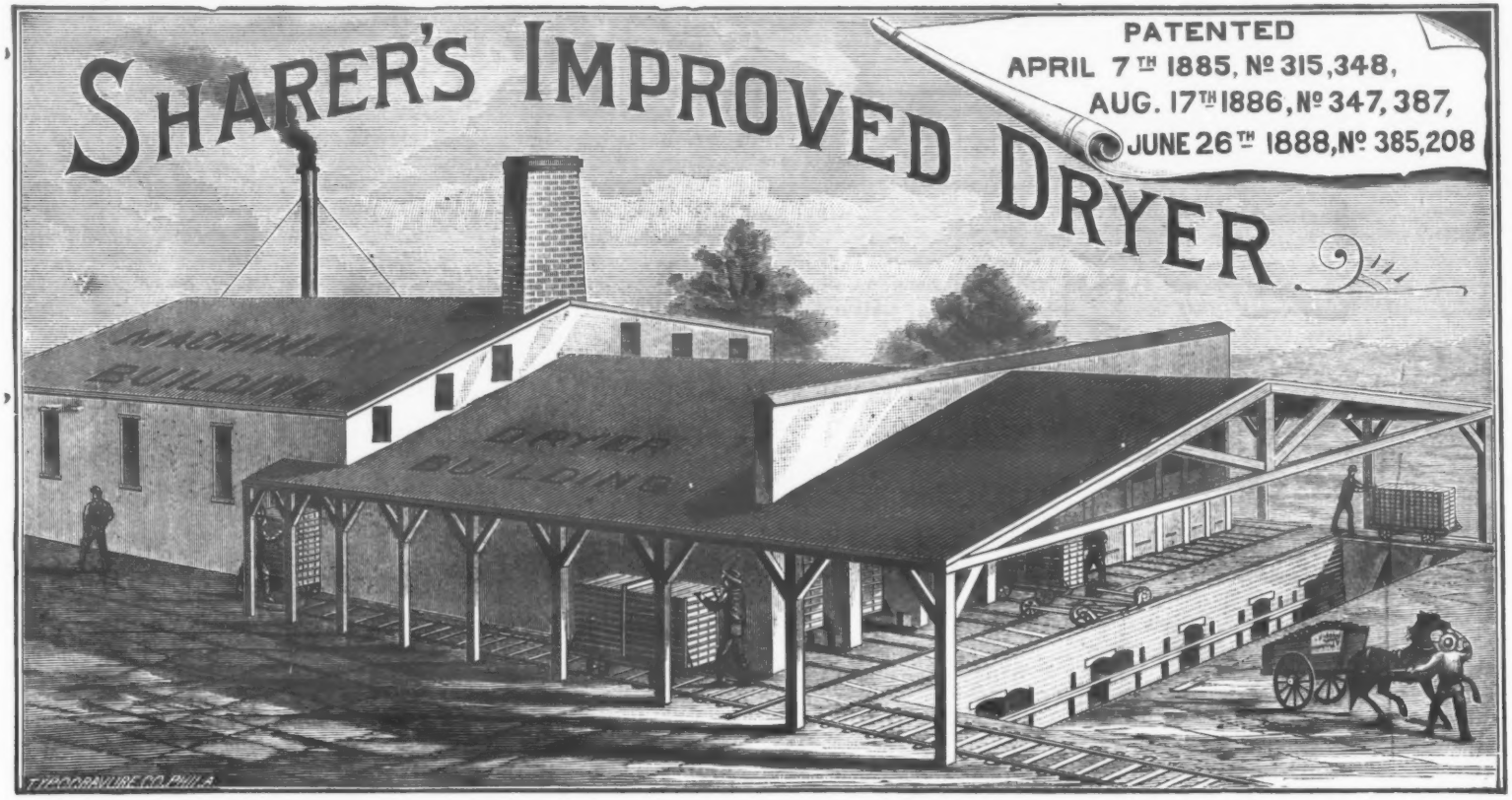

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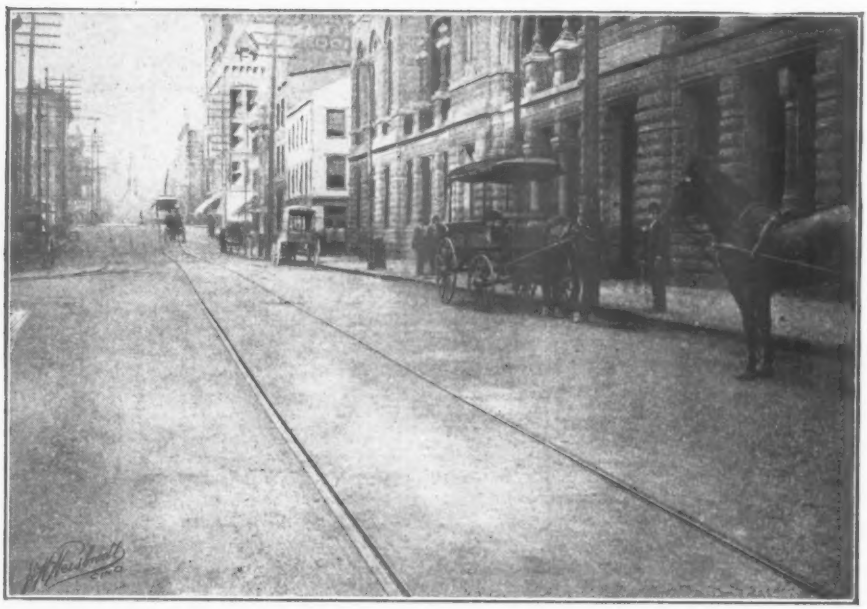

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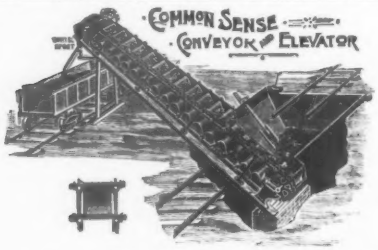

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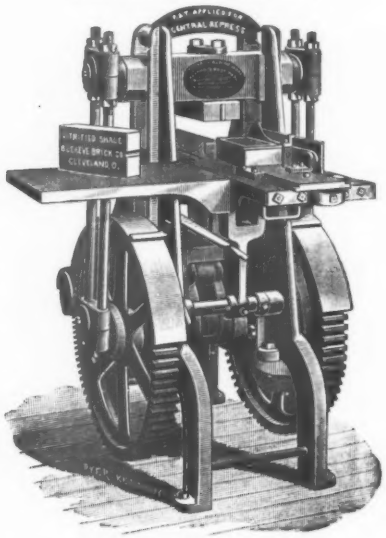

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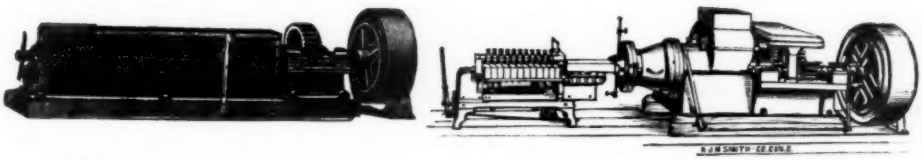

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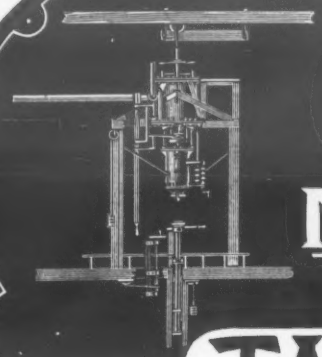

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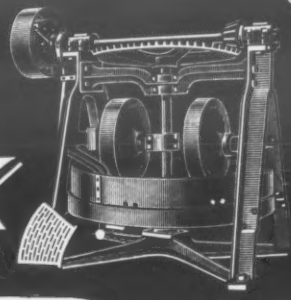

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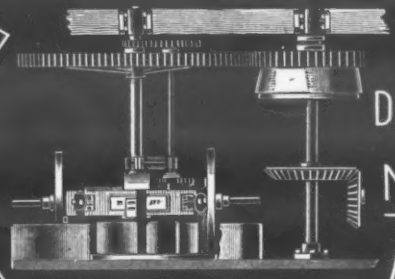

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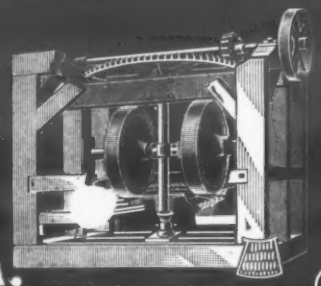

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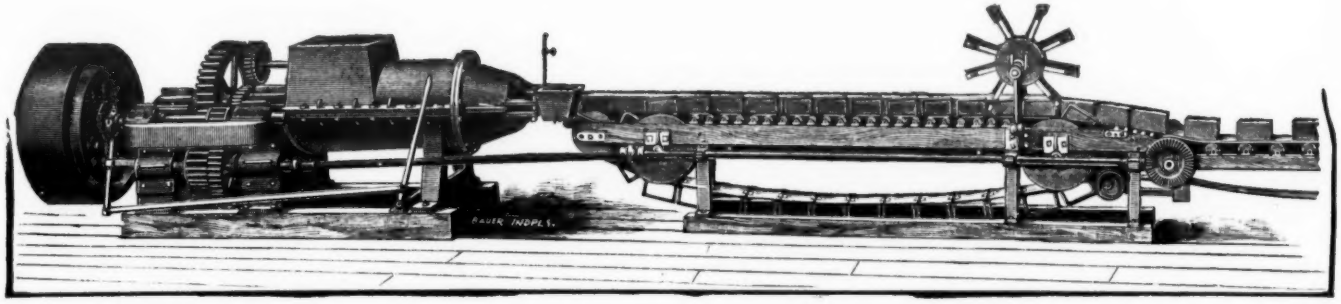

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BRICK MACHINERY

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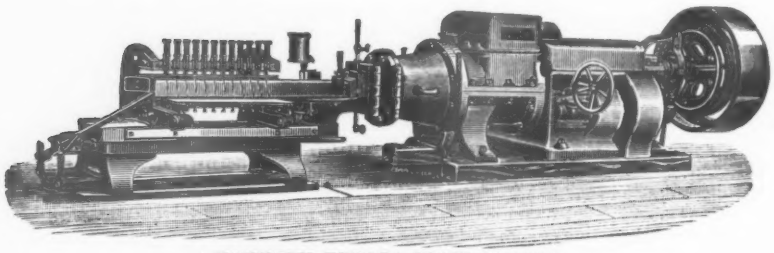

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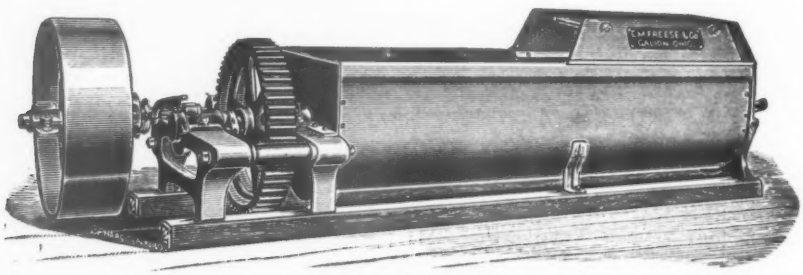

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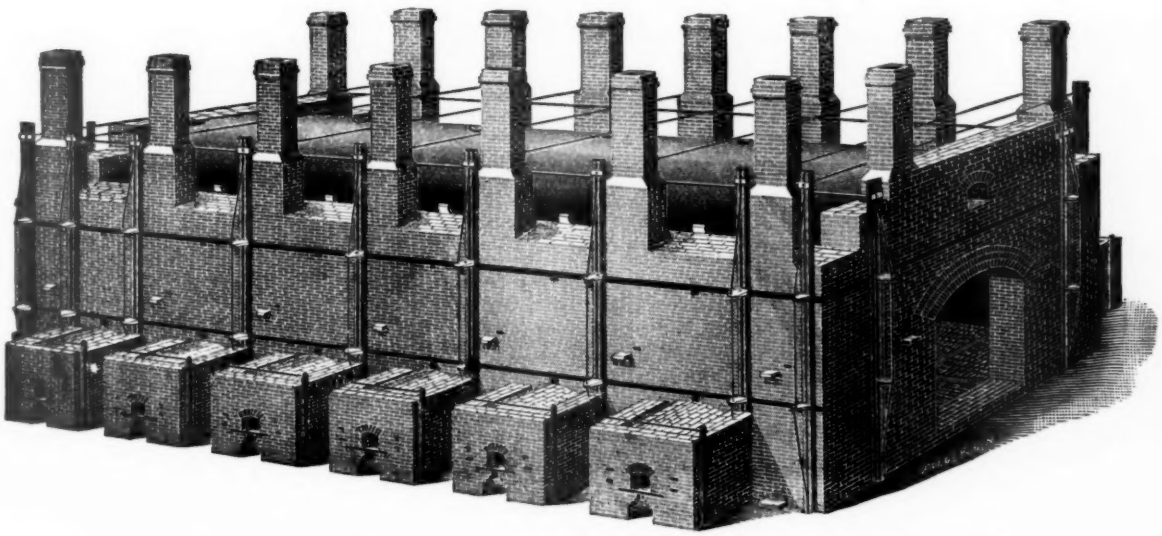

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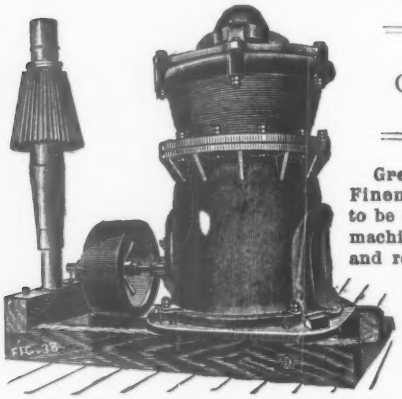

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Size 5	25 to 40 tons per hour
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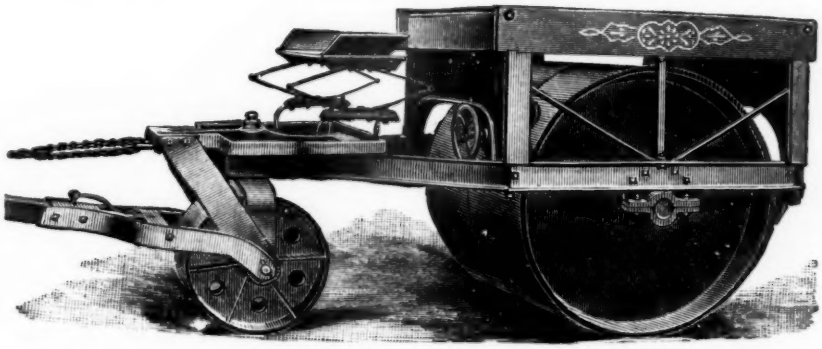

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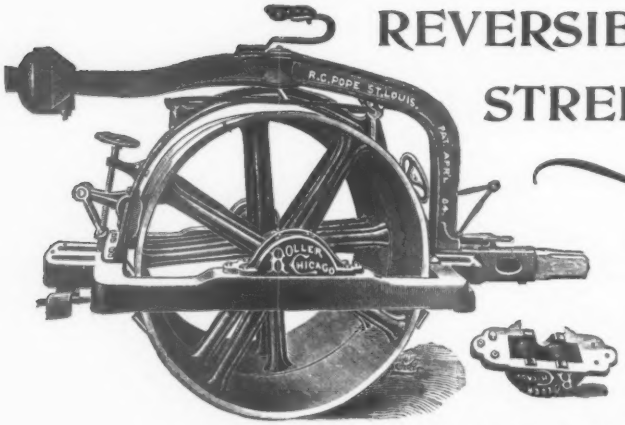

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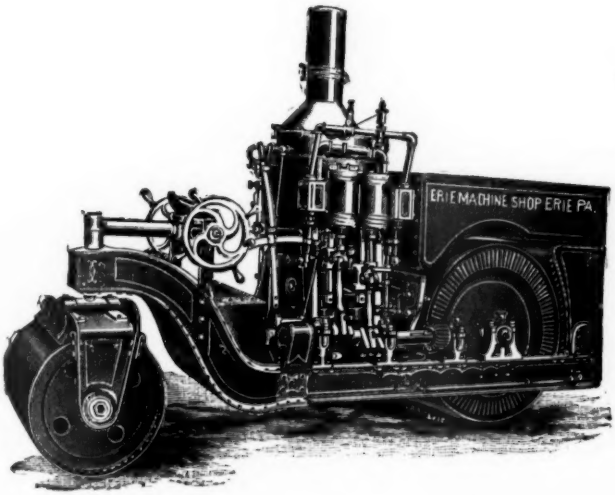

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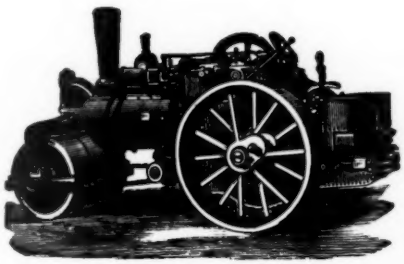

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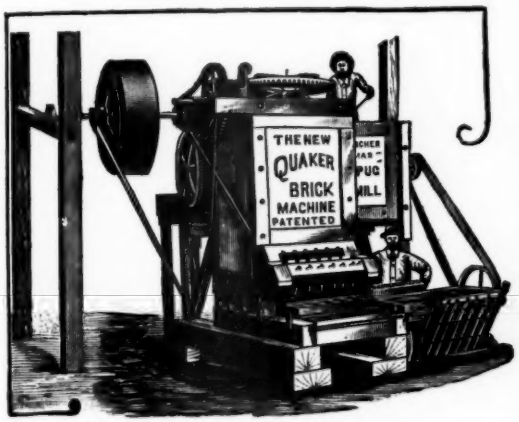

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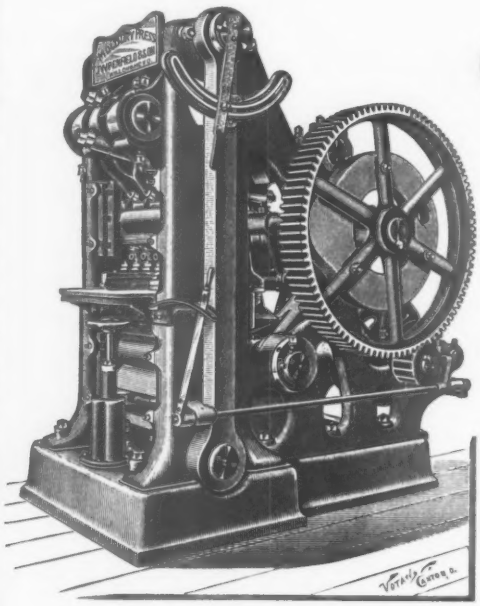

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